OCTOBER 1958 VOL. 20 NO. 11

MINING WORLD

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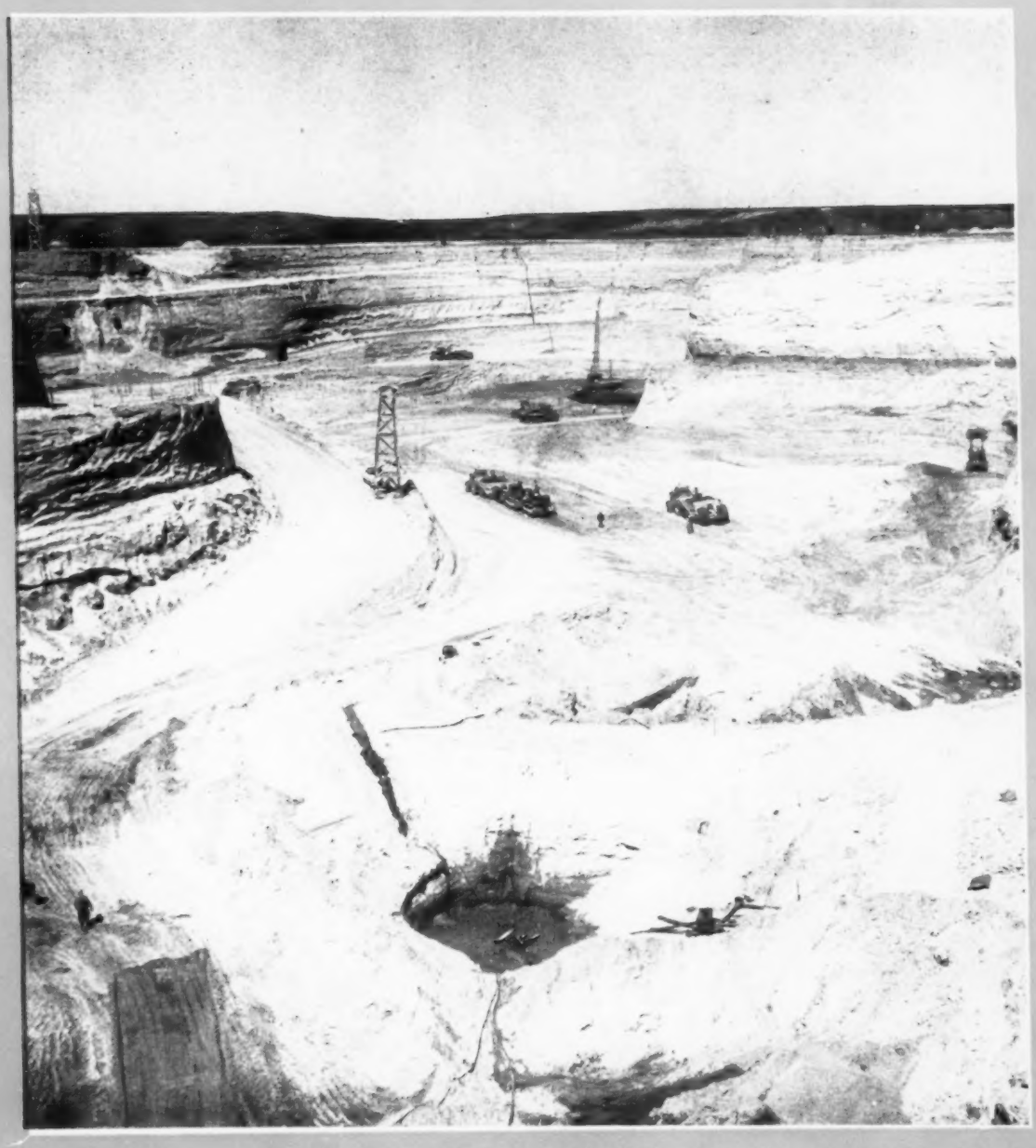

Lucky Mc: Wyoming's Biggest Uranium Producer

Page 30

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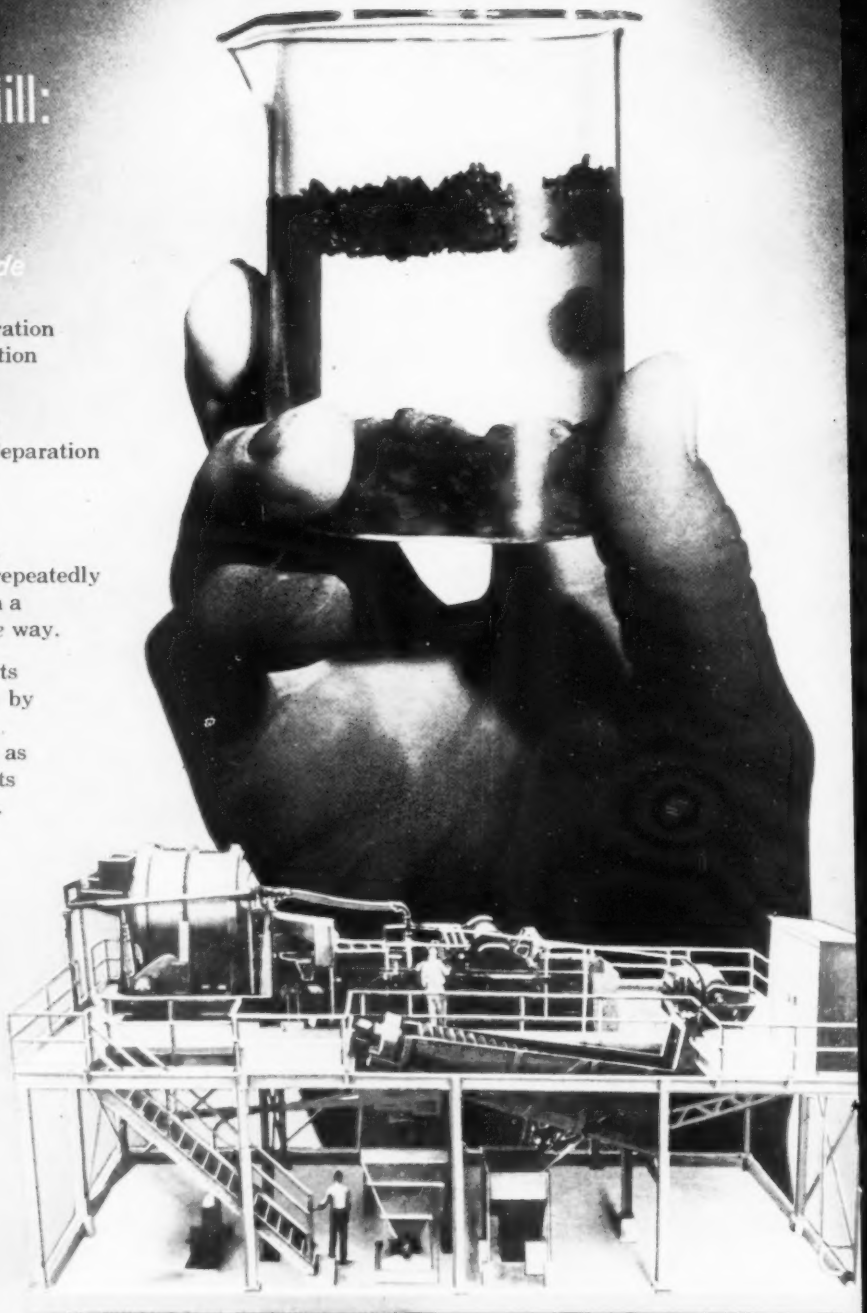

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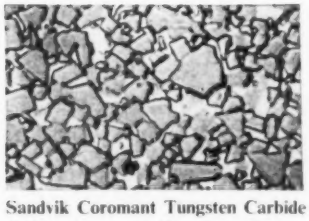
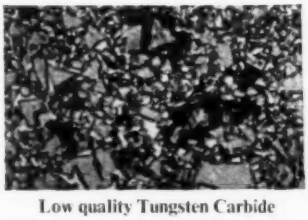


Sandvik Coromant Tungsten Carbide (Microphoto) Uniformity of size, even distribution of grain are marked. Free from porosity and impurities —therefore stronger, longer-lived.



Low quality Tungsten Carbide (Microphoto) Black marks are contaminations caused by deficient production control. They weaken the carbide, reduce its working life.

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		1⅜	1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½	2¾	3	3½	4	4½	5
SHOULDER	F	x	x														
	113	x															
	H		x	x	x	x											
	115		x	x													
	D					x	x	x	x	x	x	x	x				
	K												x	x	x	x	
BOTTOM	1" Rope			x	x	x											
	200			x	x	x											
	1¼" Rope					x	x	x	x		x		x				
	400						x		x		x						
	1½" Rope										x	x	x	x	x		
	600										x	x	x	x			
	700												x	x			
	J. 7.5														x	x	
	2" Rope													x	x	x	x

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CAT D8 TRACTOR-NO. 463 SCRAPER DIGS PROFITS OUT OF ALABAMA QUARRY

Cat D8 Tractor-No. 463 Scraper stripping overburden in mining operation near Tarrant, Ala. The haul averages 300 ft.

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A Caterpillar D8 Tractor with No. 463 Scraper strips overburden that ranges from 12 to 28 ft. thick. A Marion Back Hoe powered with a Cat D315 Engine assists in this function. The stone then is shot at a depth of about 50 ft., and a D7 pushes the rock to the quarry floor.

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Mining World

Including the Export Edition **WORLD MINING**

Published monthly except in April when publication is semi-monthly

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BY J. E. HARPER

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ON THE COVER

All kinds of action take place in the bottom of one of Lucky Mc's open pits in Wyoming, where selective mining follows bulk stripping. This is Lucky Mc's 4A pit; it measures about 1537 feet long and when picture was taken was 137 feet deep.

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MINING WORLD, October, 1958. Volume 20, No. 11 Published monthly except April, when publication is semi-monthly at Emmett St., Bristol, Conn. Executive, advertising and editorial offices, 500 Howard Street, San Francisco 5, California. Subscription in United States, North, Central, and South America, $4.00 per year; other countries, $5.00 per year. Entered as second class matter Oct. 10, 1951 at the Post Office at Bristol, Conn., under act of March 3, 1879. Postmaster: please send notice 3579 to MINING WORLD, 500 Howard Street, San Francisco 5, Calif.

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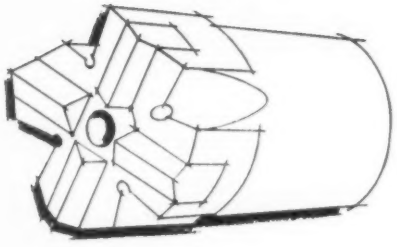
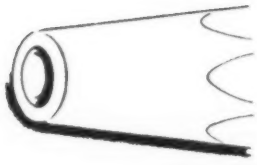


REMOVABILITY



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IN AN AIR-LEG BIT!

AIR-LEG drillers, now you can have your cake and eat it, too. The new Timken® tapered socket bit is removable—yet gives you the strength of one-piece steels. The secret is the taper. It gives you all the advantages of removability with a strong, secure union.

Here are a few of the plusses you get with the Timken tapered socket but can't get with intraset steels because they're not removable.

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4. You don't have to lug the whole steel back to the shop to resharpen the cutting edges. You do with a 4-point intraset steel.

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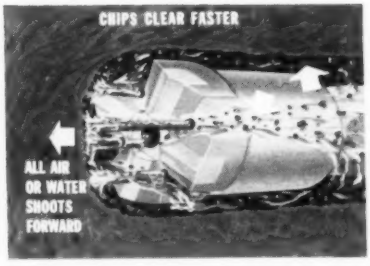
And you get further economies because the Timken tapered bit clears chips faster. The picture at right shows you how. New special-analysis carbide inserts give superior wear-resistance with added shock-resistance. And they can be reconditioned many times.

For removability *and* strength, use the air-leg bit of the future. Write for our free brochure. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".



CHIPS CLEAR FASTER because 1) new five front holes shoot water or air directly against the rock face and 2) new deeper, wider wing clearance lets chips wash back faster.

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Murray Hill 3-9295

Dist. Mgr., New York .. A. E. Roberts

Vancouver Office
402 Pender St. West
MUtual 5-7287

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Published by American Trade Journals, Inc
Wm. B. Freeman, President
L. K. Smith, Vice President
Miller Freeman, Jr., Sec-Treas.
WORLD MINING is published the 26th of each month as a regular department of MINING WORLD and is also circulated as a separate publication on a carefully controlled free basis to a selected list of management and supervisory personnel associated with active mining enterprises throughout the world.

Mining World Subscription Rates

U.S., North, South and Central America	$4.00
Other Countries	$5.00
Single Copies	$ .50
Directory Number	$1.00

CHANGE OF ADDRESS:
Send subscription orders and changes of address to MINING WORLD, 500 Howard St., San Francisco 5, Calif. Include both old and new addresses and zone numbers.

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MILLER FREEMAN PUBLICATIONS

Drifts and Crosscuts

Mining World's New London Representative

Meet Bernard W. Lansdowne, MINING WORLD-WORLD MINING'S new United Kingdom manager who will headquarter in London to represent Miller Freeman Publications' technical magazines in the United Kingdom.

Mr. Lansdowne has had wide experience as a mechanical engineer in Europe following his education at the Southall Technical College. For a number of years he was editor of *Gas and Oil Power*, and wrote a monthly technical report of "What's Going On In England" for the United States magazine, *Diesel and Gas Turbine Progress*. He is an associate member of the Institution of Mechanical Engineers.

During his extensive European travel as sales engineer for Messrs. A. E. C. Limited of Southall, Mr. Lansdowne formed a large number of contacts in the engineering profession. His engineering experience and editorial background make an unusual and well qualified combination to serve MINING WORLD readers.

Congress Passed Some Mining Legislation

Defeat of the Seaton Minerals Stabilization Plan by the House of Representatives of the 85th Congress will long be remembered in the mining camps from Virginia to California.

Some good to the mining industry did come from Congress:

Uranium Purchase Funds totaling $680,000,000 were finally approved. Some $300,000,000 is available for domestic purchases at an average price of $9.24 per pound. Foreign purchases are estimated to average $10.77 per pound.

New Depletion Rule will permit miners to make combinations of properties within an operating unit so long as each combination contains all mineral interests that comprise a complete mine or mines. Where a single deposit is being developed by two or more mines, the taxpayer can treat deposit as more than one property. Combining units can be made after development, rather than under the old law where combinations were made before exploration.

Assessment Year Changed for unpatented mining claims so period for doing annual assessment work runs from noon 1 September to noon 1 September of succeeding year. All claim owners HAVE FROM 1 JULY 1958 UNTIL NOON 1 SEPTEMBER 1959 to do next assessment.

Exploration Aid Continued by setting up Office of Minerals Exploration as successor to DMEA. Limit of $250,000 per contract, loan not more than 50 percent of cost of project, and repayment of federal funds with interest as a royalty on value of production. Interest at average Treasury rates, plus 20 percent to cover administrative costs.

Geological, Geophysical, and Geochemical Labor for annual assessment work was approved. The surveys must be conducted by qualified experts and verified by detailed report filed with the county clerk or recorder in which claim is located. This detailed report must set forth fully, (a) the location of work performed in relation to point of discovery and boundaries of the claim; (b) the nature, extent, and cost thereof; (c) the basic findings therefrom; and (d) the name, address, and professional background of the person or persons conducting the work. The law limits the use of such surveys to not more than two consecutive years, or for more than a total of five years on any one claim, and no survey may be repetitive of any previous survey on the same claim. Such surveys also are restricted to those made on the ground.

ENGINEER'S FIELD REPORT

PRODUCT RPM DELO OIL

FIRM PORTER BROTHERS CORP.
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Operates 7,000 hours without measurable wear

Lubricated with RPM DELO Oil, this 650-hp Ingersoll-Rand diesel is still in nearly new condition after three years' service. "We found no carbon sludge or lacquer when we tore it down last winter," says Power Plant Foreman Bill Niece (above). "And there was no measurable wear on rings, liners or bearings, though it had run more than 7,000 hours!" Engine is in power plant of Porter Brothers Corp. Firm dredges for strategic minerals under government contract.

Trucks hauling firm's ore work 'round the clock, 9½ months a year. Despite the tough punishment of carrying heavy loads over unpaved mountain roads, RPM DELO Oil keeps engines running smoothly, and eliminates excessive wear.

Giant dredge (left) processes nearly 6,000 yards of gravel every 24 hours. "Both this and our smaller dredge depend upon our diesel-generators for power," explains Superintendent Clay La Fon (right). "That's why we do everything possible to keep them running properly...and that includes using RPM DELO Oil. We've had excellent results with it in all our equipment...in our power plant, in our trucks, and in the tractors that level our tailings and restore the areas we've worked."

Why RPM DELO Oils reduce wear—prolong engine life

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MINING WORLD NEWSLETTER

San Francisco . . . Manitouwadge . . . Lovelock
October 1958

The statistical outlook for metals is better!

Copper and zinc stocks are down—copper showing an 8 percent cut on a world-wide basis; slab zinc stocks at U.S. smelters show first substantial decrease since November 1956.

Lead-zinc will be limited to 80 percent of average commercial imports for the five-year period from 1953 to 1957, as President Eisenhower establishes an import quota. Details and operational procedures are still to be announced.

Dollar value of lead imports dropped from $10,900,000 to $7,500,000 in May and June although actual tonnage showed no appreciable decline.

A better balance between mine production and consumption is being achieved. Where demand has been ahead of supply for some time, the pendulum seems to be swinging the other way now.

Copper price stabilization was considered unnecessary by the 40 nations attending the United Nations three-day conference on the copper situation, indicating a more favorable demand-to-production ratio.

New uses for these metals are being energetically sought, as plastics, synthetics, and rubber take some of the old markets. The lead and zinc industries' joint research program is getting underway with support of producers all over the world. They plan to develop new products and specific applications aimed at increasing world-wide consumption of lead and zinc.

Most optimistic metal of the moment is mercury where U.S. production is still running way ahead of last year. Official government figures just released confirm MINING WORLD's reports of mercury activity in the September issue.

Still a boom camp is Canada's Elliott Lake uranium district. Twelve mines and eleven mills are in operation.

But copper-cobalt make big news any day!

Nearly 1,000,000 tons of Cu-Co ore reportedly have been outlined by Pater Uranium, which originally staked the claims for U_3O_8.

Manitouwadge, Ontario, overlooked for many years, is now the scene of Geco Mines Ltd.'s 3,300-ton copper-zinc operation.

The district has a potential for supporting two or three other mines. Already 500,000 tons of zinc ore have been outlined in what may prove to be a third zone in the small greenstone belt.

Prospecting in greenstone is now very active following Geco's discovery in an area for years believed to be unmineralized.

A new copper stripping job in Chile is being figured very closely by Isbell.

A beneficiation feasibility study and economic evaluation of Southern Pacific Railroad's iron ore deposits near Lovelock, Nevada are being undertaken by a well known consulting engineering firm. Initial agreement with SP calls for a six-man crew to make a three-month study.

AEC approval is all that is holding up Federal Uranium Corporation's plans for building a uranium processing mill in the Gas Hills of Wyoming.

Now developing the Acari mines in Peru, Wells Overseas may soon move into Chile. Most Acari ore is said to be destined for Bethlehem Steel furnaces.

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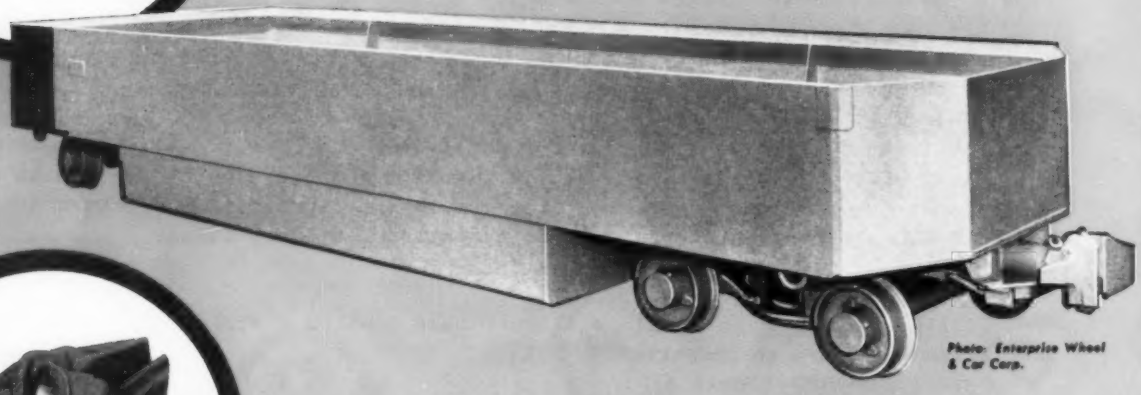

Photo: Enterprise Wheel & Car Corp.

WILLISON AUTOMATIC COUPLERS

In 1951 Olga Coal Company bought 300 coal cars equipped with National NC-1 Trucks, National rubber cushioning devices, Willison Automatic Couplers and Naco Steel Wheels.

Based on experience with the 300 original cars, Olga Coal purchased an *additional* 120 cars. And now Olga Coal has placed a *third* order for 40 more cars. This brings Olga's modern fleet up to 460 units—*all 100% National-equipped.*

This is typical of the swing to National-equipped mine cars—for safety . . . for longer life and lower maintenance . . . for lower per-ton mining costs.

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Capitol Concentrates

House Kills Seaton Mineral Plan; Tariff Recommendation Back To Ike

The Administration's program for stabilization of the domestic minerals industry went down to defeat in the House of Representatives on August 21. The roll-call vote on the bill (S. 4036) was 182 to 159. It would have provided for stockpile purchases of copper; stabilization payments over a five-year period to domestic producers of lead, zinc, fluorspar, and tungsten; and incentive payments on limited quantities of beryl, chrome, and columbium-tantalum.

The measure, known as the Seaton Plan, had been passed by the Senate in July by a vote of 70 to 12.

Final defeat of the bill came after three days of debate. Congressmen from the mining states ably presented the urgent need for the legislation, but they were too few in number to offset the determined opposition of those who called the program "a $650,000,000 gift to big American mining companies who are importing minerals, then demanding a subsidy to protect themselves from imports."

During the debate, the House adopted an amendment reducing the proposed authorization to appropriate funds for the program from $650,000,000 to $458,000,000; eliminated tungsten and fluorspar from the program; limited benefits to small mining firms; sharply restricted the quarterly production of any producer which would be eligible for stabilization payments; and adopted an amendment which stated: "No payment shall be made under this act to any producer which shall declare any dividend or transfer any funds to a surplus account, during the calendar or fiscal year in which it applies for or receives any payment hereunder."

Rejection of the bill was followed by pleas for immediate action by the President to raise import duties on lead and zinc in accordance with recommendations of the Tariff Commission submitted to him last April. At that time the commission announced its unanimous findings that lead and zinc are being imported into the United States in such increased quantities as to cause serious injury to the domestic lead-zinc industry, but split 3-to-3 in recommending remedies. In June, President Eisenhower notified Congress that he was suspending his consideration of these recommendations and that a final decision would be appropriate after Congress had "completed its consideration during this session of the proposed minerals stabilization plan." Western Senators and Representatives are now urging that he take prompt action.

Recommendations of the Tariff Commission are subject to the terms of the new Trade Agreements Act, according to most attorneys. However, one segment of the legal profession maintains that the President has lost his authority to act by his failure to take the required steps within the specified time limit.

Terms of the new authority provided in the Trade Agreements Act permit the President to raise the rates 50 percent above the ad valorem equivalent of the 1934 rates based upon 1934 values. According to a spokesman for the Tariff Commission, this authority would make the maximum permissible increases as follows: pig lead, 11.2 cents per pound; slab zinc, 7.8 cents per pound. These figures are based on values prevailing during the first four months of 1958. The copper industry has not petitioned for relief under the "escape clause" procedure.

The mining industry had accepted the Seaton Plan (S. 4036) as a "temporary alternative" although expressing a definite preference for higher tariffs. The Administration had opposed higher duties because of the impact on foreign countries and had advocated the subsidy program instead. However, despite a last-day appeal by Secretary Seaton to all Republican members of the House, the Administration was unable to secure sufficient support to offset the determined opposition. Failure of Congress to provide relief, particularly for lead and zinc, has created a desperate situation for the mining companies—and placed the Executive Branch of the government in a most embarrassing position.

• Stockpiling Plans For 1959 Are Disclosed

Two types of mica (muscovite block and film), amosite asbestos, and diamond dies will be purchased for the national stockpile during the current fiscal year, according to an announcement by the Office of Civil and Defense Mobilization. The amounts of these materials to be purchased are kept secret for security reasons, the agency said.

The mobilization office also reported that several materials now in the stockpile will be processed to put them into more readily usable forms. Among the items that will be upgraded are oxygen-free copper, a specialty metal used in electronics. Officials said the specialty copper would be upgraded in very small amounts. Other items to be upgraded include ferro-molybdenum, ferrovanadium, molybdic oxide, and tungsten carbide powder. In each case the amount to be upgraded will be limited to quantities needed to meet the initial surge of demand in a mobilization period.

Congress provided $3,000,000 in the stockpile appropriations for the fiscal year 1959, but the agency also has carryover funds exceeding $70,000,000.

• Early Closing Of Fluorspar Mines Expected

The Administration in general seems to be unconcerned about domestic production of fluorspar, in spite of its increasing use in critical industries. The Bell Aircraft Company recently developed a rocket fuel using liquid fluorine, which is reported to give 40 percent more thrust than any previous fuels. The Independent Fluorspar Association members are said to have notified their workers that the mines will be closed down as soon as the government's present acid-grade purchase program ends, before the end of this year. This will be good news for the fluorspar importers!

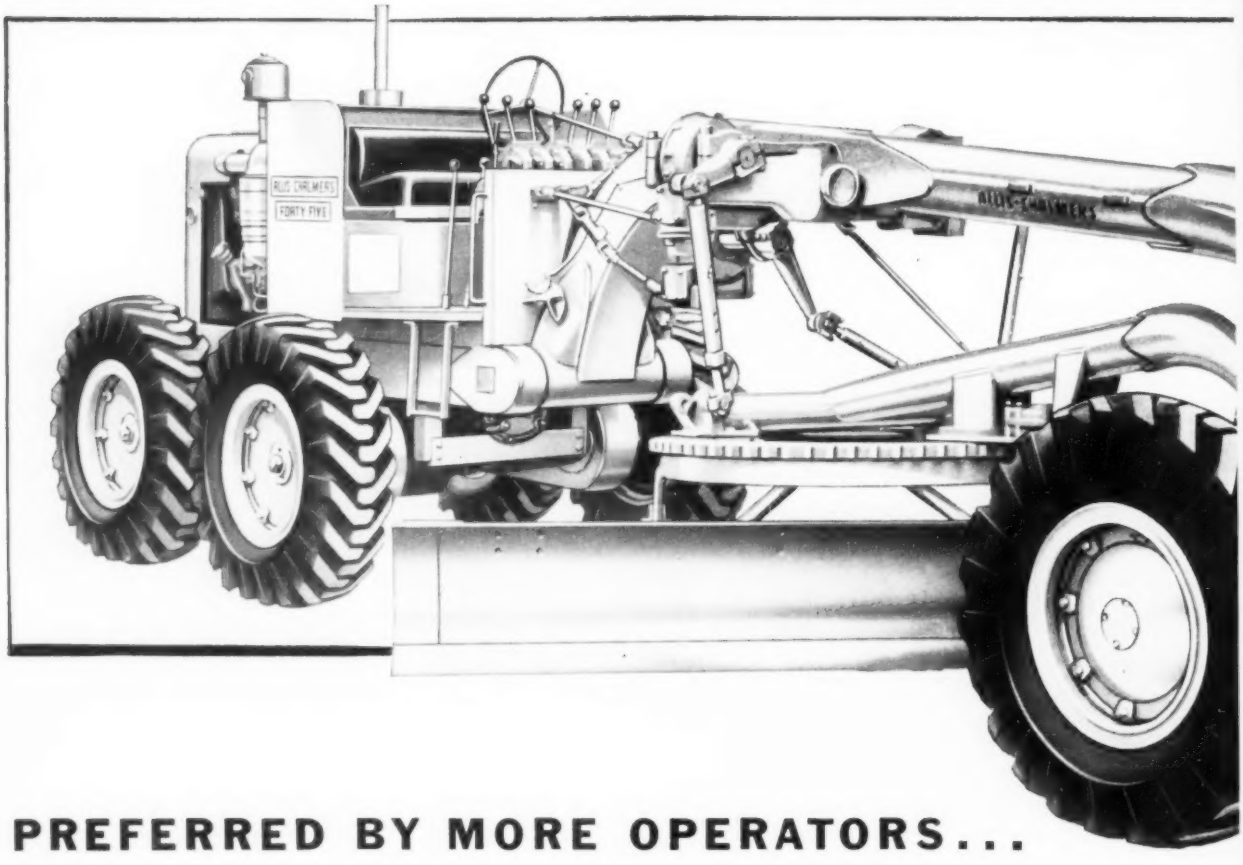
• Fluorspar-Asbestos Extension Is Vetoed

The President's veto of S. 3186, the bill to extend for one year the fluorspar and asbestos provisions of Public Law 733, did not come as too much of a surprise.

The statement that the asbestos program has enough appropriations to carry it through to the completion of the quantities now authorized to be purchased was beside the point. If the year's extension had been authorized, an amendment could have been passed early in the first session of the 86th Congress to increase the purchase quota. The real fact is, the government does not want the asbestos.

As for fluorspar, the argument that S. 4036, the Seaton Stabilization Bill, would take care of everything, was somewhat premature, to put it mildly.

For consistently tough jobs, compare with any other heavy-duty motor grader



PREFERRED BY MORE OPERATORS... BOUGHT BY MORE USERS EVERY DAY

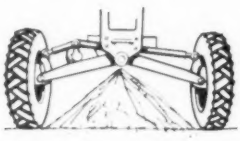
The FORTY FIVE has the power, weight, traction and speeds you need for high-production grading. Superior stability and precision control give you deep precision cuts or smooth finishes. The FORTY FIVE is built to take the shocks and strains of heavy-duty service — and to keep production steady. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Look ahead... *move ahead* ...and stay ahead with **ALLIS-CHALMERS**

Allis-Chalmers FORTY FIVE performance

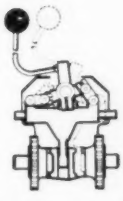
- 120 brake hp
- 6 forward speeds to 20.6 mph
- 3 reverse speeds to 7.0 mph
- 23,800 lb approx.

Advantages that mean more production . . . less maintenance . . . easier and better operation



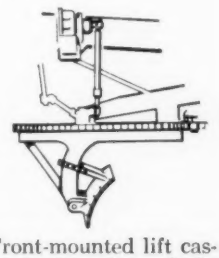
Extra high axle and throat clearance means bigger loads at the blade.

The ROLL-AWAY moldboard rolls dirt, gives more performance per horsepower, more production per gallon.



Toggle-type controls are exclusive with Allis-Chalmers.

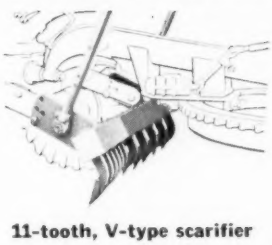
Fully enclosed power steering — easy control under all conditions.



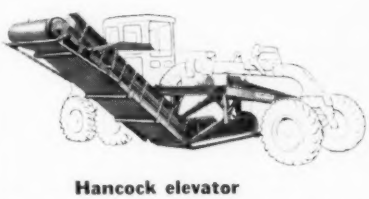
Front-mounted lift cases eliminate long shafts that twist under loads.

Matched attachments and accessories make it a year-round producer

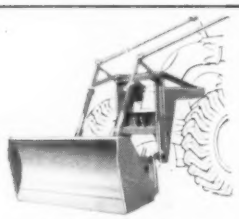
All-steel, stand-up cab



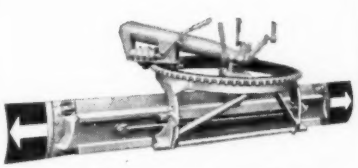
11-tooth, V-type scarifier



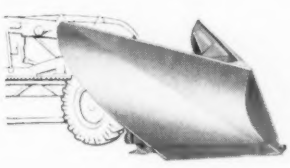
Hancock elevator



8-foot bulldozer



Hydraulic, shiftable moldboard



V-type snowplow

ROLL-AWAY is an Allis-Chalmers trademark.

AN ANNOUNCEMENT OF UNUSUAL IMPORTANCE!

S-D GISMO TRANSLOADER

A Self-Loading... Self-Dumping Transport

THE GISMO TRANSLOADER is a one-man operated SELF-LOADING and SELF-DUMPING TRANSPORT . . . a self-loading truck that shuttles back-and-forth between muck pile and dumping point without the synchronization of several pieces of equipment or positioning of equipment to load. It WORKS FULL SHIFT — loading, transporting and dumping in continuous, uninterrupted performance-cycles! It offers unusually low cost capital investment to do the job, as well as the lowest possible cost per ton for labor and maintenance. The Gismo Transloader is an advanced equipment development . . . the perfectly natural result of the performance of the Gismo powered by crawler-mounted tractors conceived a few years ago and doing an outstanding job in mechanized mining today! Write today for complete literature and information. *Manufactured by Sanford-Day Iron Works, Inc., Knoxville, Tenn.*

SANFORD-DAY

- S-D Mine Cars, all types and kinds
- Precision S-D Mine Car Wheels
- Tough, year-after-year wheel service by special S-D Hard Facing Process (this can really save you money and eliminated downtime)
- S-D "Brownie" Car Spotting Hoists—mine, industrial, railroad, etc.
- S-D Hydraulic Car Spotters, all types, including special drop bottom car spotters.
- S-D Mine Sheaves and Rollers
- S-D Automatic Loading Stations for Mine Car and Railroad Car loading points
- S-D Slusher-Trains for mining and construction industries
- S-D Gismo and S-D Gismo Transloader for mining, quarry and construction industries

Gismo dipper actually digs-in below grade, at operator's option, to maintain level and cleaned-up haulageway regardless of bed condition.

This new high-speed, power-packed 5-D GISMO TRANSLOADER is an entirely pneumatic-tired 4-wheel self-loading and self-dumping transport developed for long hauls, and featuring:

- HIGH SPEED TRANSPORTING . . . up to 20 miles per hour either direction—three speeds, forward or reverse with directional travel lever!

- NO TURNING or positioning for loading. Machine travels equally as well either direction!
- POSITIVE NO JACKKNIFING in mucking operation!
- POWER BRAKES . . . POWER STEERING . . . TORQUE CONVERTER!
- HAND-HANDY CONTROLS OPERATE DIPPER AND DUMP DOORS!
- PNEUMATIC TIRES to eliminate spring maintenance.
- OSCILLATING - COUPLING - UNIT ACTION and NO CONVENTIONAL STEERING MECHANISM usually associated with 4-wheel machines . . . therefore, less maintenance.

SANFORD-DAY

KNOXVILLE, TENNESSEE

Gismo Transloader moves large boulder rocks for secondary blasting . . . backfills or dumps directly into bin or ore pass . . . or by simple ramps over trucks, cars, conveyors, etc.

"JOB-TAILORED ESCO DRAGLINE BUCKETS SOLVED OUR DOWNTIME, MAINTENANCE PROBLEMS"

...reports Howard Harrison, mechanical supt., C. A. Pitts General Contractor Ltd., Toronto.

"The material in which we are working," explains Howard Harrison, mechanical superintendent on a St. Lawrence Seaway job involving the removal of 16-million yards of glacial till, "is an extremely hard mixture of clay, gravel and boulders." "Our original buckets broke down frequently in this unexpectedly tough going. Maintenance was costing us more than $100 per week per bucket. Then we checked with our *ESCO* representative, who sent *ESCO* bucket specialists to look into our problem. They recommended the use of two 6-yard *ESCO* HDH Triple Tapered buckets, custom-engineered to our requirements. The *ESCO* buckets immediately reduced our maintenance costs, and we were able to work the two draglines with only one spare bucket for each instead of two previously required."

ESCO bucket specialists can furnish dragline buckets tailored to your specific requirements. See your *ESCO* dealer for details, or write direct.

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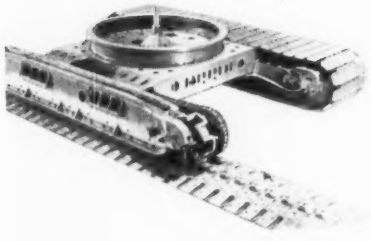
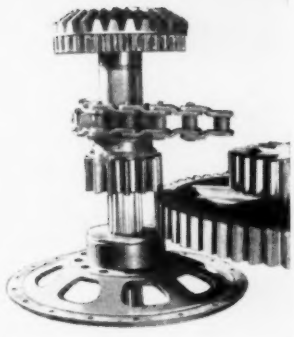


a quick guide to increased mining output with the Manitowoc 4500

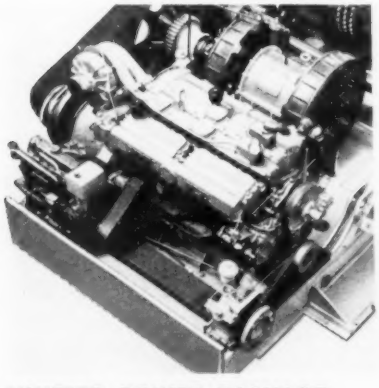


SOLID STABILITY

Look at this massive carbody and these long, wide crawlers! A solid base and a low ground bearing pressure of only 9.6 lbs. per sq. inch let you work right at the edge of a bank.

DIRECT POWER FLOW

No one but Manitowoc gives you a slide pinion design that directs power straight to the "business end". Only gears that are working turn and there are only 15 gears in the entire unit!



UNIFIED POWER PACKAGE

The 4500 is diesel engine powered with the capacity to tackle any job. There are no fussy electric motors . . . no dead-weight . . . no delicate circuits.

GREATER MOBILITY

Your operator travels steep grades without "babying" his machine . . . there's no rocking when moving. Lets you mine anywhere! And fast between job moves can be made by rail or highway trailer.

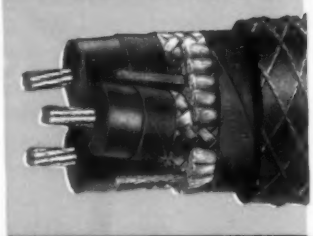
HI-LIFT BOOM

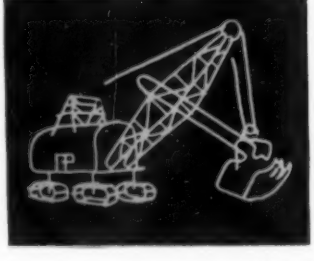
A 60′ Hi-Lift shovel boom and a 45′ stick are available to give extra reach and height. Standard 120′ dragline boom handles 6-yd. bucket . . . special 140′ boom and 4-yd. bucket extends digging range.

the more reason for using TIREX®

TIREX cords and cables give longest service when not subjected to severe abuse. But when required, TIREX can take it. In snow and mud, under water and under pressure, TIREX cords and cables remain flexible, smooth, light and easy to handle, thanks to their original cured-in-lead construction. They won't snag or tear, and their fortified and tempered neoprene armor gives balanced resistance to abrasion, water, acids, oils, sunlight and flame.

Millions of feet of TIREX are on the job everywhere—transmitting power for mobile mining equipment, construction machinery and portable tools.





Simplex WIRE & CABLE COMPANY

79 SIDNEY STREET, CAMBRIDGE 39, MASS.

"The American manufacturers of transoceanic telephone cables"

CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

AEROSPRAY 52 Binder reduces wind loss in mineral fines shipment . . . prevents stockpile erosion*

AEROSPRAY 52 Binder is a concentrated resin emulsion which is finding wide application in the mining industry. First used to prevent wind loss of fine coal in transit, AEROSPRAY 52 Binder is now also used to treat shipments of sulfide concentrates and coke breeze. It also is effective for preventing dusting and rain erosion of stockpiled fines and tailings.

For example, coal losses in a 400-mile haul have been reduced substantially by treatment with AEROSPRAY 52. Formerly, unsprayed cars lost as much as three to four tons in transit.

Applied as a water spray, AEROSPRAY 52 sets up to form a tough crust in the surface layer of the mineral or coal fines. As shipped, AEROSPRAY 52 Binder contains 46 to 48% solids and is diluted with water to 3 to 10% for spraying.

Write for our brochure on AEROSPRAY 52 Binder. Samples are available on request.

*Trademark

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

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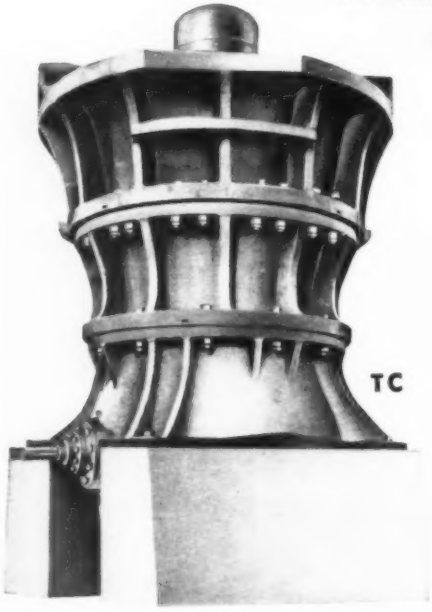
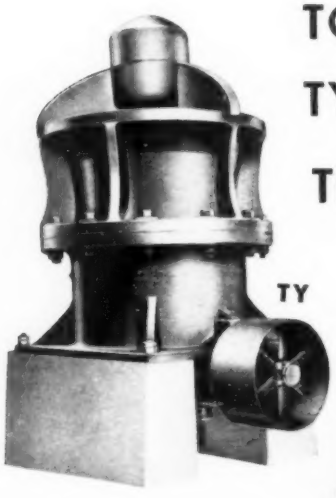
Traylor

EXPERIENCE

is built into these precision-engineered

GYRATORY CRUSHERS

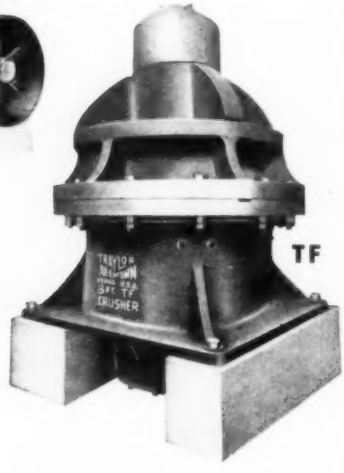




TC Built in six sizes with capacities ranging from 245 tons of a 2" product to 4100 tons of an 11" product.

TY Built in six sizes from 1'—3" to 5'—6" with feed openings from 3" to 22".

TF Fine Reduction Crusher for operators whose needs demand economic production of 5/16" to 1¼" material in large capacity.

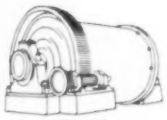


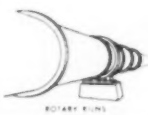
The Traylor Type TC Gyratory Crushers feature the non-choking, self-tightening bell head and curved concaves, a Traylor original development. The Traylor patented dust seal provides a practical and efficient device for excluding dirt from the lubrication chamber. The Traylor TY and TF require less head room due to compact, simplified design. These reduction crushers also have Traylor original curved concaves and self-tightening bell heads. For the most advanced crushing machinery designed to create greater profits for the operator—write to Traylor for detailed information.

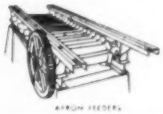
TRAYLOR ENGINEERING & MFG. CO.

2002 Mill St., Allentown, Pa.

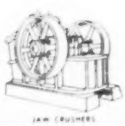
Sales Offices: New York — Chicago — San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.


BALL MILLS

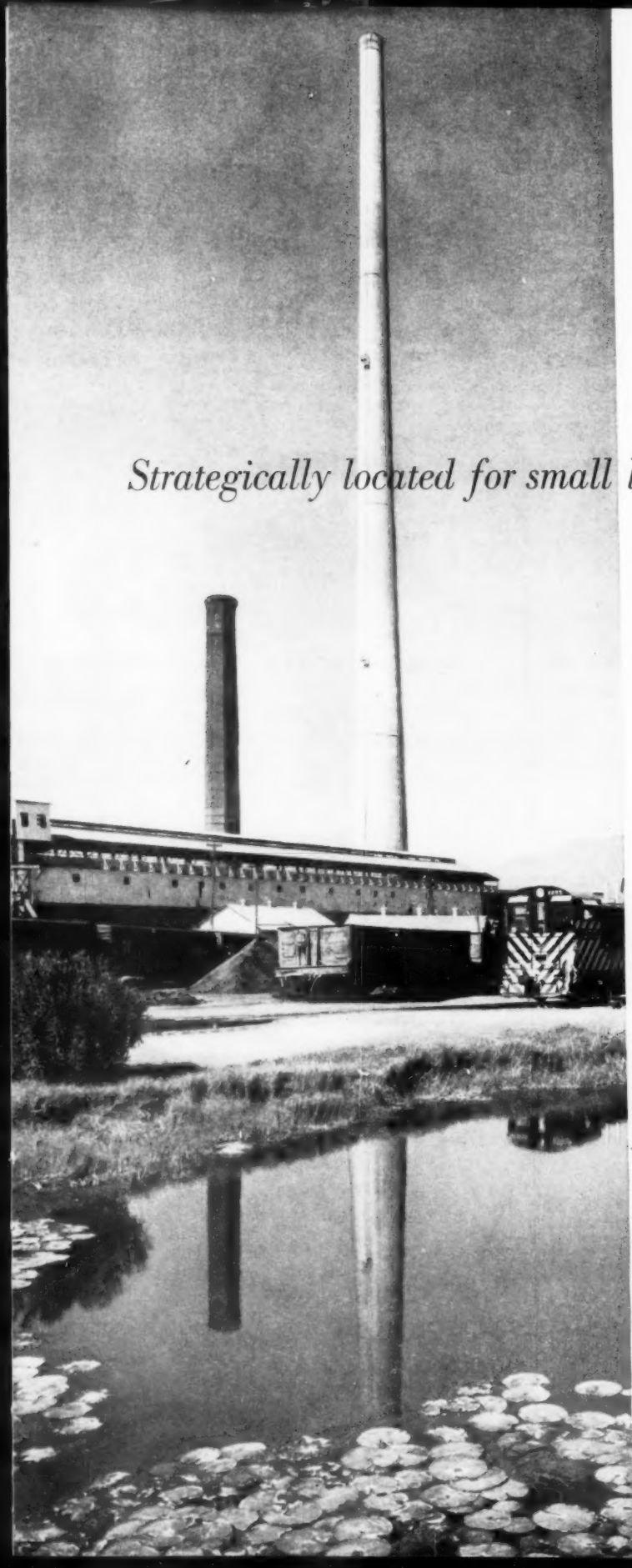

ROTARY KILNS


APRON FEEDERS

PRIMARY GYRATORY CRUSHERS


JAW CRUSHERS

SECONDARY GYRATORY CRUSHERS



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buying, smelting, and
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GOLD, SILVER, LEAD,
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and concentrates, blister
copper, mattes and residues
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Strategically located for small lots or carload quantities...

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Corpus Christi, Texas
Rosita, Coah., Mexico

COPPER SMELTERS
Hayden, Arizona
El Paso, Texas
Tacoma, Washington
San Luis Potosi, S.L.P., Mexico

LEAD REFINERIES
Selby, California
Omaha, Nebraska
Perth Amboy, New Jersey
Monterey, N.L., Mexico

COPPER REFINERIES
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Tacoma, Washington

See management
at above locations
or write to main office,
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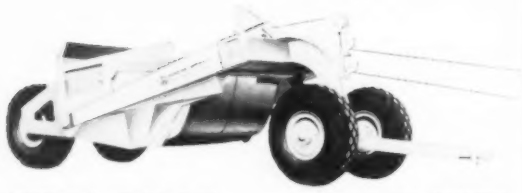
58-54

ASARCO



MODEL CWT-8

8.0 cu. yds. STRUCK
10.5 cu. yds. HEAPED

AVAILABLE IN 10.0 and 13.5 CU. YDS.

MODEL CW-27

7.0 cu. yds. STRUCK
10.0 cu. yds. HEAPED

MODEL CWT-15

15.0 cu. yds. STRUCK
21.0 cu. yds. HEAPED

MODEL CW-215

15.0 cu. yds. STRUCK
21.0 cu. yds. HEAPED

INTERCHANGEABLE WITH MODEL CWD-214 REAR DUMP UNIT

MODEL CWT-20

20.0 cu. yds. STRUCK
27.0 cu. yds. HEAPED

MODEL CW-220

20.0 cu. yds. STRUCK
27.0 cu. yds. HEAPED

INTERCHANGEABLE WITH MODEL CWD-221 REAR DUMP UNIT

MODEL CWT-26

26.0 cu. yds. STRUCK
33.0 cu. yds. HEAPED

MODEL CW-226

26.0 cu. yds. STRUCK
36.0 cu. yds. HEAPED

INTERCHANGEABLE WITH MODEL CWD-221 REAR DUMP UNIT

MODEL CW-320

INTERCHANGEABLE WITH MODEL CWD-321 REAR DUMP UNIT

20.0 cu. yds. STRUCK
27.0 cu. yds. HEAPED

MODEL CWD-321

INTERCHANGEABLE WITH MODEL CW-320 SCRAPER UNIT

21.0 cu. yds. STRUCK
31.0 cu. yds. HEAPED
35-TON LOAD CAPACITY

A SCRAPER FOR EVERY EARTHMOVING JOB . . .

CURTISS-WRIGHT

CONSTRUCTION MACHINERY

Curtiss-Wright Construction Machinery offers the most extensive scraper line in the industry! These rugged, dependable high speed machines — produced at South Bend — incorporate design features that give contractors the versatility and performance that pays off in lower costs-per-yard and bigger profits on any earthmoving job.

And supporting performance in the field is the nationwide network of Curtiss-Wright distributors with a staff of factory-trained service personnel and extensive parts stocks. Factory parts depots located strategically throughout the country cut downtime on major overhauls too.

For scraper performance that means bigger earth moving profits — see your Curtiss-Wright Construction Machinery distributor today.

SOUTH BEND DIVISION
CURTISS-WRIGHT CORPORATION
SOUTH BEND, INDIANA

MODEL CWT-30

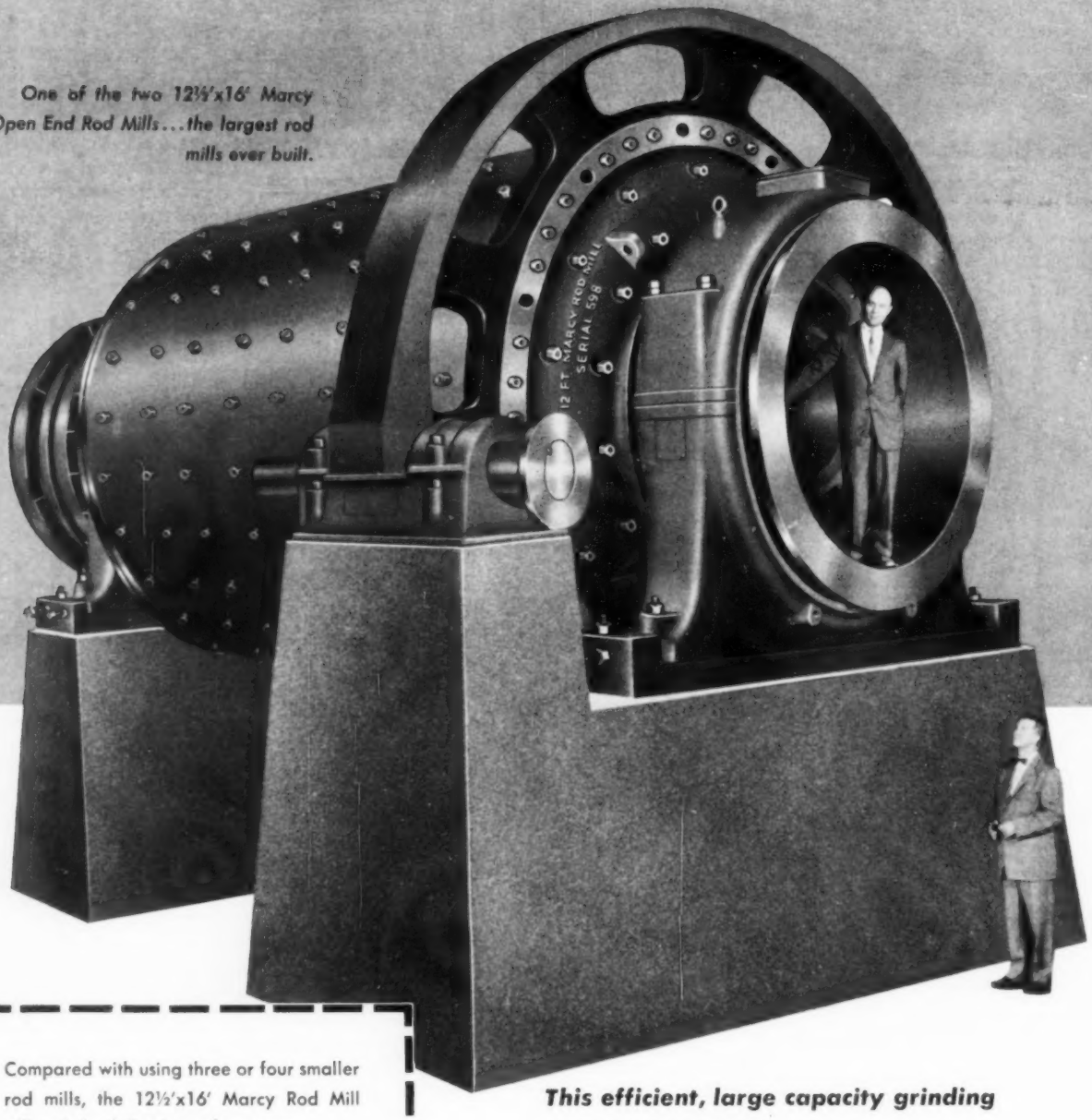
30.0 cu. yds. STRUCK
39.0 cu. yds. HEAPED

MODEL CWD-214

INTERCHANGEABLE WITH MODEL CW-215 SCRAPER UNIT

14.0 cu. yds. STRUCK
21.0 cu. yds. HEAPED
25-TON LOAD CAPACITY

How 12½'x16' Marcy Rod Mills



One of the two 12½'x16' Marcy Open End Rod Mills... the largest rod mills ever built.

Compared with using three or four smaller rod mills, the 12½'x16' Marcy Rod Mill offered the following advantages...

- **Lower initial cost**
- **Less floor space**
- **More efficient grinding**
- **Less power per ton**
- **Lower labor costs**

This efficient, large capacity grinding is made possible by...

- Mine and Smelter's specialized experience in the design and manufacture of grinding mills, and
- The Marcy principle of grinding..."rapid change of mill content is necessary for high efficiency," which is accomplished by the open end feature in Marcy Rod Mills.

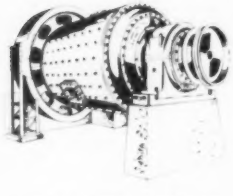
For consultation on your grinding problems contact Mine and Smelter's grinding engineers.

Solve Milling Problem, Reduce Costs

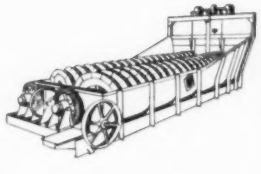
An Arizona copper company, planning a new mill, wanted to grind 12,000 tons per day. To handle this capacity would require three or four mills, based on mill sizes available at that time.

Mine and Smelter, in cooperation with this copper company and its consulting engineers, proposed 12½' x 16' Marcy Open End Rod Mills... the largest ever built... each mill to have a capacity of 6,000 tons per 24 hours grinding from ¾" to approximately 10 mesh.

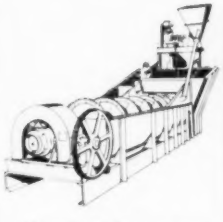
Other Products for the Mining Industry



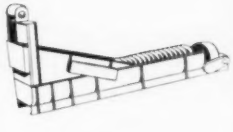
Marcy Grate Discharge Ball Mills



Akins Classifiers



Akins HMS Separators



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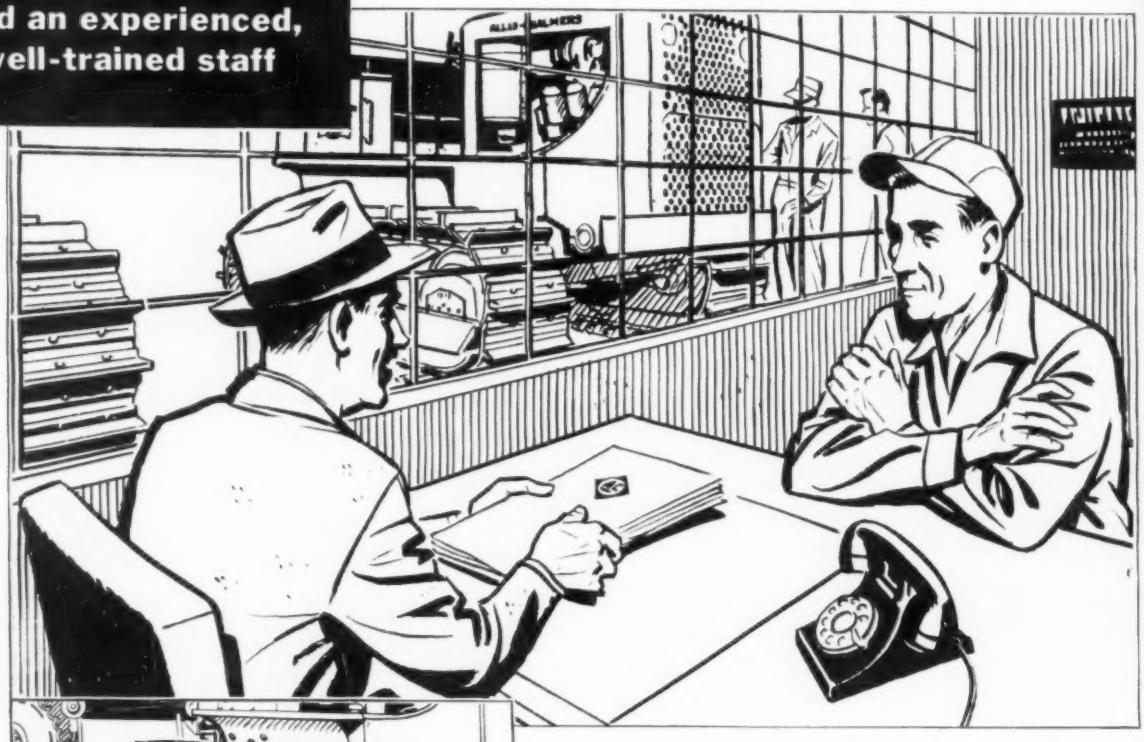
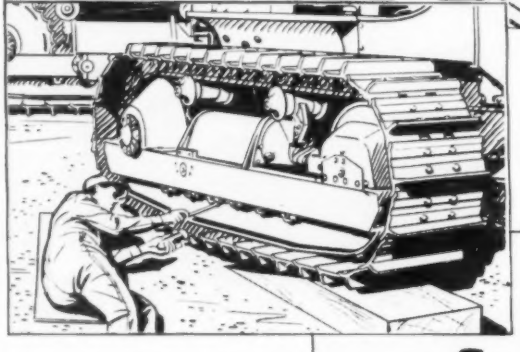
Your Allis-Chalmers dealer

...backed by modern facilities and an experienced, well-trained staff

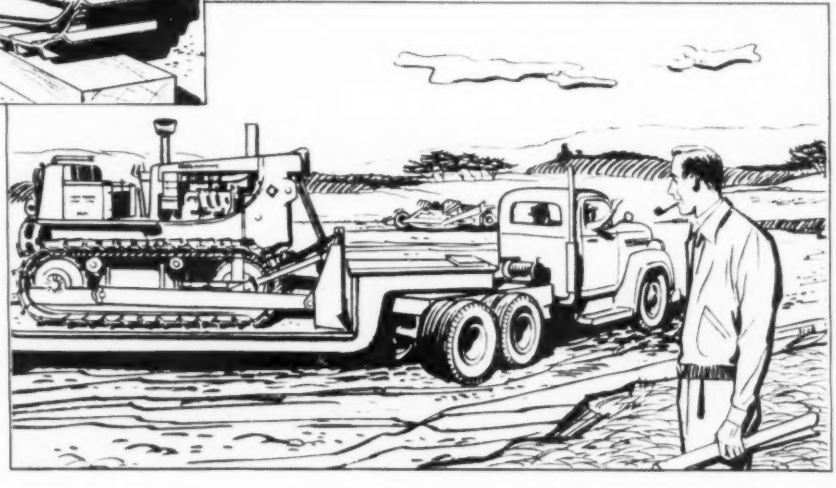
Your Allis-Chalmers dealer *knows* the equipment he sells. He can give you the expert service in shop and field that results in "like-new" performance from every Allis-Chalmers unit in your fleet... keeps them producing on your jobs.



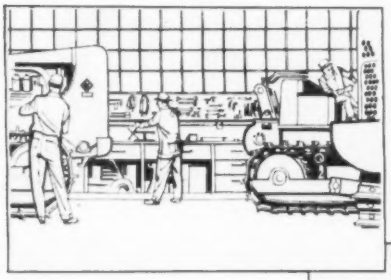


Detailed information on maintenance, adjustments and other facts on care of the machinery is delivered with the equipment. Operating tips are passed along to your men—to help them get started right and get the most from their equipment.

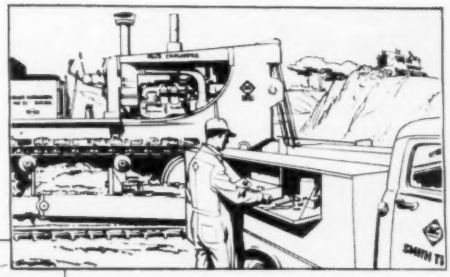
Careful pre-delivery servicing assures that Allis-Chalmers construction machines have been thoroughly checked ...and that they're ready for work as soon as you get them.



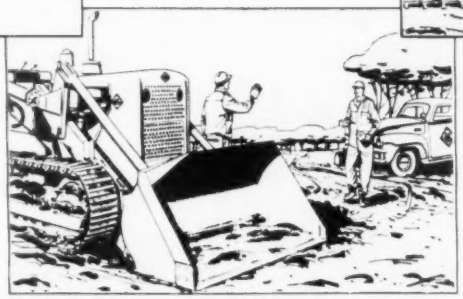
is a specialist in service



Shop service at your Allis-Chalmers dealer is fast and efficient—because it's handled by factory-trained men, using factory-approved tools, equipment and methods. Specialized mechanics and special facilities all help to speed service.



Scheduling checkups with your Allis-Chalmers dealer will insure that proper maintenance procedures are followed . . . stop trouble before it starts . . . keep your machines producing.



Prompt field service—a call—any time, day or night—brings a qualified serviceman and a fully equipped "mobile workshop." Result—problems can be quickly and accurately solved . . . equipment put back on the job with minimum delay.

. . . backed by a ready stock of original specification parts

ENGINEERED RIGHT

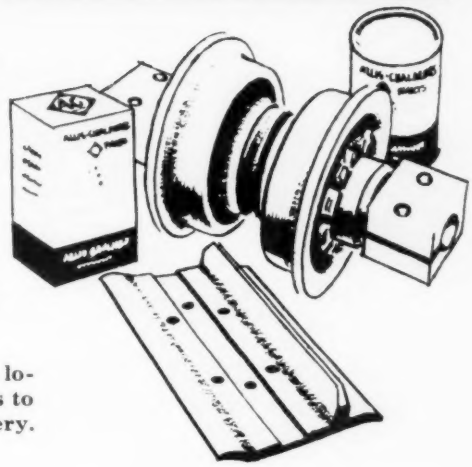
Allis-Chalmers parts are designed as original equipment . . . benefit from intensive metallurgical research. And each comes from the drawing boards of experienced construction machinery engineers.

MANUFACTURED RIGHT

Precision-made parts assure long-life service. They're made by skilled craftsmen on modern industrial machinery and are subjected to original-equipment inspection and testing.

TO PERFORM RIGHT

Each part is made of top-quality material, heat-treated to correct hardness and made to exact specifications. You can depend on them for full-capacity production on the toughest jobs you have.



The men of your Allis-Chalmers dealer organization know local conditions. Look to them for equipment recommendations to fit your job requirements . . . for true value in used machinery.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

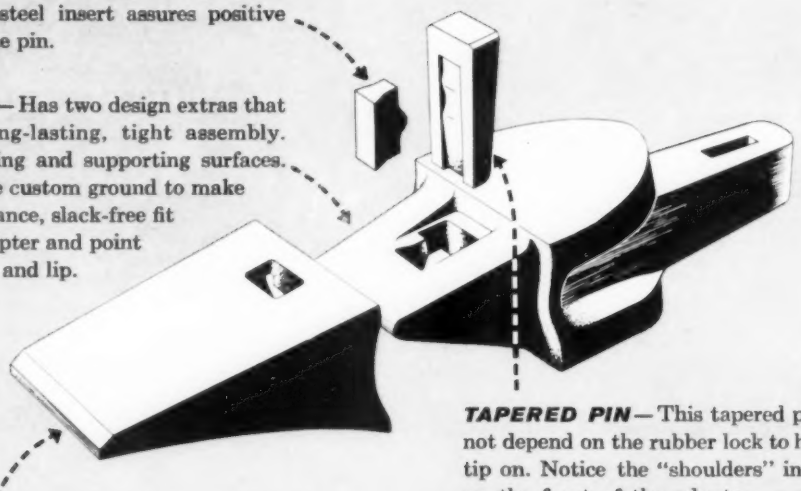
Look ahead... *move ahead*...and stay ahead

with ALLIS-CHALMERS

NEW AMSCO® 2 PART TOOTH

PIN LOCK — Special high-strength rubber with a steel insert assures positive locking of the pin.

ADAPTER — Has two design extras that assure a long-lasting, tight assembly. Larger bearing and supporting surfaces. Adapters are custom ground to make a close-tolerance, slack-free fit between adapter and point and adapter and lip.



REVERSIBLE TIP — Enables you to get longer digging life while maintaining sharpness.

TAPERED PIN — This tapered pin does not depend on the rubber lock to hold the tip on. Notice the "shoulders" indicated on the front of the adapter . . . and the mating shoulders on the pin. These shoulders lock the tip in place with metal-to-metal contact. The rubber lock, in turn, locks the pin in place.

3 big features for fewer shovel shutdowns

1 You get up to four times extra wear over other 2-part teeth. We cast these new teeth of a tougher, new and special heat-treated alloy that slashes your replacement and maintenance costs.

2 These reversible teeth stay sharp, to penetrate cleanly and easily without straining your shovel. Reversing point is easy. This reversible feature is particularly important on corner teeth. It maintains digging efficiency throughout tooth life.

3 Positive locking device — Amsco's unique pin-locking design secures tip to adapter in tight, positive, metal-to-metal contact.

Order the Amsco 2-part Simplex from your local power shovel dealer.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DEL., OAKLAND, CAL., ST. LOUIS, JOLIETTE, QUEBEC

Exclusive features of Tournapulls include power-transferring differential and instant action, weatherproof, easy-to-maintain electric controls. Dump-body can be interchanged behind prime-mover with scraper, crane, and other types of hauling units, at low cost.

Typical 600-meter round trip work cycle for Tournapull Rear-Dump takes about 8 minutes. Positioning in pit, and loading, averages 5 minutes; travel to hopper, 1.5 minutes; positioning at hopper and dumping, 0.5 minutes; return averages 1 minute.

At quarry in Ecuador...

Big changes result when new Rear-Dump is put to work

Equipment particularly well-suited to its work can often produce *remarkable* results. Excellent proof of this fact is being demonstrated near Guayaquil, Ecuador, at Goat Hill quarry, where the Guayas Province Highway Commission produces its paving materials. Some time ago a 10-metric ton (11-ton) Model D Tournapull Rear-Dump was put to work hauling from rock pit to crusher. Since then, this has happened:

1) The Tournapull has replaced 4 of the quarry's 5 dump trucks. The operations staff has been reduced by two drivers and one mechanic.

2) Substantial savings have been realized on maintenance. This includes major reductions in time, parts, fuels, and lubricants. The Tournapull has needed just one replacement part in six months, at a cost of under $90, U.S.

3) A serious tire wear problem has been solved. Road and pit surfaces at Goat Hill are such that each of the ordinary trucks formerly used wore out 18 tires each year. The Tournapull tires have never been off their rims, and are still in near-perfect condition.

4) Production has increased. In the past, whenever two or more trucks were downtimed at the same time, all operations at the quarry were slowed or halted. Today, these delays have virtually disappeared. Instead, extra drilling and blasting shifts have had to be scheduled to prepare enough material to make use of the improved production capacity.

Consider Tournapull Rear-Dumps for your operations. Available with capacities of 10, 20, and 32 metric tons (11, 22, 35 tons), they are fast, dependable, sturdily-built. Ask for complete specifications.

Tournapull—Trademark Reg. U.S. Pat. Off.
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LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

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Where quality is a habit

Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

October 1958

INTERNATIONAL PANORAMA

SAN FRANCISCO, CALIFORNIA—North American Nickel Company has been formed to bid on the United States government nickel plant at Nicaro, Cuba when the plant is sold. Bunker Hill Company, St. Joseph Lead Company, Falconbridge Nickel Company, and Blyth and Company form North American Nickel.

GRANTS, NEW MEXICO—Mid Continent Uranium Corporation is sinking a new shaft to develop the Barbara J. No. 3 uranium ore body in Poison Canyon.

SALT LAKE CITY, UTAH—United Western Minerals Company, prominent uranium company in Ambrosia Lake, is acquiring the claims and leases of Sahara Uranium Corporation, and Anticline Uranium Company.

MONTREAL, CANADA—Production of copper, lead, zinc, and silver during first six months of 1958 was larger than for the similar period of 1957. Nickel output declined slightly.

DARWIN, AUSTRALIA—Reynolds Metal Company's subsidiary, Reynolds Pacific Mines Pty., Ltd., has discovered large bauxite deposits on Croker Island off the coast of Arnhem Land.

MOAB, UTAH—Uranium Reduction Company has made the first large shipment of uranium concentrates for conversion to nuclear reactor feed materials. This first sale other than to AEC was made to W. R. Grace & Company's Davison Chemical Division at Irwin, Tennessee.

RAY, ARIZONA—Kennecott Copper Corporation has placed its four western open pit mines on a six day per week production basis to meet demands for copper. This increases production from 26,100 to 29,900 tons per week.

BABBITT, MINNESOTA—Reserve Mining Company broke 1,140,000 tons of taconite ore here with a record blast of 625,000 pounds of powder. The previous record was held by Southern Peru Copper Corporation which broke more than 1,000,000 tons of waste with 270,000 pounds of powder.

SANTA RITA, NEW MEXICO—A 40-ton inclined skip hoisting system is going to be installed at the Chino copper pit of Kennecott Copper Corporation. About 18,000 tons per day will be hoisted 600 feet vertically from pit bottom.

LONDON, ENGLAND—Copper producing nations have agreed not to establish a production-price-stabilization plan to balance supply and demand.

SAN FRANCISCO, CALIFORNIA—Imports of zinc into the United States in the first six months of 1958 were 348,824 tons; down from 409,039 for same period last year. Refined lead imports increased to 209,899 tons from 149,970 in 1957.

LANDER, WYOMING—Susquehanna Corporation which controls Mines Development Inc. with a uranium mill at Edgemont, South Dakota and Fremont Minerals Inc. which is building a new uranium mill at Riverton, Wyoming has contracted to buy the Gas Hills mines of Vitro Minerals Corporation for about $11,500,000. Purchase of Vitro assures an expanded ore source for the new mill.

KITWE, NORTHERN RHODESIA—Kanshanshi Copper Mining Company, Ltd. will sink a new shaft to expedite dewatering of the flooded mine workings. The mine has been completely flooded since November 1957.

SYDNEY, AUSTRALIA—Rutile is being exported to Red China under terms of a barter agreement. The initial shipment of 3,500 tons was largely supplied by Zircon Rutile Ltd., and Crescent Rutile N. L.

LUANDA, ANGOLA—A 50,000 annual ton aluminum plant will be built for Aluminio Portugues (Angola) S. A. R. L. by the French aluminum firm, Pechiney.

TORONTO, CANADA—An important copper-zinc discovery has been made in the Mattagami Lake Bell River district by Kennecott Copper Corporation's Canadian subsidiary—Kennco Explorations, Canada.

MORENCI, ARIZONA—Phelps Dodge Corporation's copper mines and mills have been placed on a five day work week to increase copper output by 3,500 tons per month. P-D had cut production by about 100,000 annual tons from the 1956 peak output.

Reserve's Record Blast Moves 1,140,000 Tons

One of the largest explosions in the history of mining was touched off at Reserve Mining Company's open pit at Babbitt, Minnesota recently, loosening approximately 1,140,000 tons of taconite ore. The 625,000 pounds of explosives were moved to the site in 12 freight cars and filled 794 blast holes, with nearly 10 miles of wire and fuse connecting the explosives. Estimated cost of the blast was $250,000.

A block 860 feet long, 360 feet wide, and 28 feet deep was moved by the explosion. It was estimated that 99.4 percent of the taconite could be taken directly to a primary crusher without further treatment, providing enough ore to run the processing plant for nearly a month.

The explosives were timed to detonate in 156 separate explosions, $^{17}/_{100}$ of a second apart, to reduce intensity of the shock and sound waves without detracting from the force of the blast.

According to company officials, this beats the record set by Southern Peru Copper Corporation, when approximately 1,000,000 tons of ore were blasted with 270,000 pounds of dynamite at the Toquepala project in Peru (See MINING WORLD, February 1957, page 103).

By contrast, one of the largest underground blasts was that of Algoma Ore Properties, Ltd. at its Helen mine near Jamestown, Ontario, Canada. Here 154,893 feet of hole were blasted, using 172,500 pounds of dynamite to move 1,131,000 tons of ore.

Copper, Aluminum Freed For Export to Soviet Bloc

All forms of copper and aluminum have been released for export of Communist bloc countries, following revision of the international list of "strategic" commodities compiled by the Coordinating Committee on the Control of East-West Trade, representing 15 western nations.

Britain (which has already sold considerable copper wire to Russia), Chile, Canada, and other countries are expected to take immediate advantage of revisions. The United States, however, will continue an embargo against shipments to Communist China, North Korea, and North Viet-Nam, but a change in policy may occur regarding sales to Russia and eastern Europe.

The first embargo list, drawn up in 1954, contained a total of 282 commodities; the revised list contains 155 commodities. Metals still included on the embargo list include boron, mercury, beryllium, uranium, thorium, titanium, and raw or treated minerals, residues, slag, and tailings which contain by weight 0.05 percent or more of uranium or thorium, and any combination, such as carnotite, pitchblende, and monazite sand.

European Report

GROWING DEMAND SEEN FOR MAJOR METALS

The strong European demand for metals has been dramatically highlighted in the United States by Kennecott Copper Corporation's recent return to a six-day work week because of increasing sales. Max F. Holsinger, MINING WORLD'S acting European Manager, had this timely report prepared on current European views regarding base metal prices and markets. The report incorporates views and opinions of leading mining executives, metal traders, and financial leaders.

The metals picture as seen by competent observers in the United Kingdom and Western Europe is beginning to emerge with better definition. There is still room for caution, but where only a few months ago neither producers nor consumers were prepared to express outright optimism about the chances of a recovery in metal prices, a more pronounced feeling has been crystallizing lately that the lowest levels of the four major base metals are being left behind.

This feeling, sensibly enough, is based not so much on any hard and fast interpretation of current statistics as on the belief that the United States recession has positively turned the corner. Since the United States must always be a dominating factor in the base metal picture, it has always been widely appreciated in Europe that a tangible turn-around in the tempo of the United States' economy was the first essential if any worthwhile recovery in metal prices were to be secured.

Nowhere had it been doubted that the secular trend in base metals was likely to be upward. For the more immediate future, the marginal producers in many districts still are grappling with the problem of whether to shut down or keep going in the hope that a turn in prices would come quickly. At this writing, it is probably correct to say that most mines in the predicament—and there are very many, indeed, all over the world—have placed the idea of shut-downs further from their minds.

There is evidence, too, that, whereas consumers have, for months, been living on hand-to-mouth inventories, they are now thinking in terms of rebuilding their metal stocks to more normal levels.

Behind this change in sentiment concerning the outlook for metals lies the more positive belief that a United States recovery may come sooner than had been expected and it may, indeed, be under way already. Over the coming months, a quickening of economic activity in the United Kingdom and Western Europe is also foreseen in some quarters. Impartial observers consider that the Macmillan Government has done a good job in its fight for the English Pound since last fall. With a general election looming ahead next year, a further relaxing of credit and other restrictions and a popular budget next spring are seen as likely developments. With de Gaulle now in power, France is now regarded as a more stable proposition, and Western Germany may start taking steps to reverse the downturn in its activity which has developed in recent months.

Copper, in London and on the Continent, as elsewhere, is read as a barometer for the entire metal price complex. The immediate copper picture, so far as the United Kingdom and Continental operators are concerned, could be seen in clearer perspective were developments in the United States to take a more direct turn. Dealers in the United Kingdom are hopeful that more trade in the metal will accrue from the recent relaxation of exports to Russia.

Meanwhile, there have been broad hints from the Nchanga Consolidated Copper Mines Ltd.'s management in Northern Rhodesia that the mine is ready to step-up production as soon as the conditions permit.

What say the chiefs of industry? Walter Gardner, chairman of Amalgamated Metal Corporation, has said of the recent cuts in production: Cuts during 1958 should reduce total world output below 3,200,000 tons and should suffice to eliminate the copper surplus. The market, he added, seems well able to respond if United States business activity picks up and in this he may already be right.

Harry Oppenheimer, talented son and successor of the late Sir Ernest, founder and guiding hand of Anglo American Corporation of South Africa Ltd., which, through Rhodesian Anglo American, controls more than half of Northern Rhodesia's Copperbelt production, has stressed that the 1956 prices for copper were exceptionally high. Also, the London equivalent of 20 cents in March was too low for long-term requirements. London observers believe that Mr. Oppenheimer and other producers think a price level of about 30 cents would make producers reasonably happy—certainly the Rhodesians—and yet would be acceptable to the consumer. Stability near this figure would discourage competition from other metals—and, after the wild fluctuations of recent years, stability of price is seen to be of as much importance as the price itself. No runaway advance, but a fairly modest one, is what is looked for in the next year.

Lead-zinc picture is thought to be following the copper pattern, so far as it can be discerned, but less emphatically.

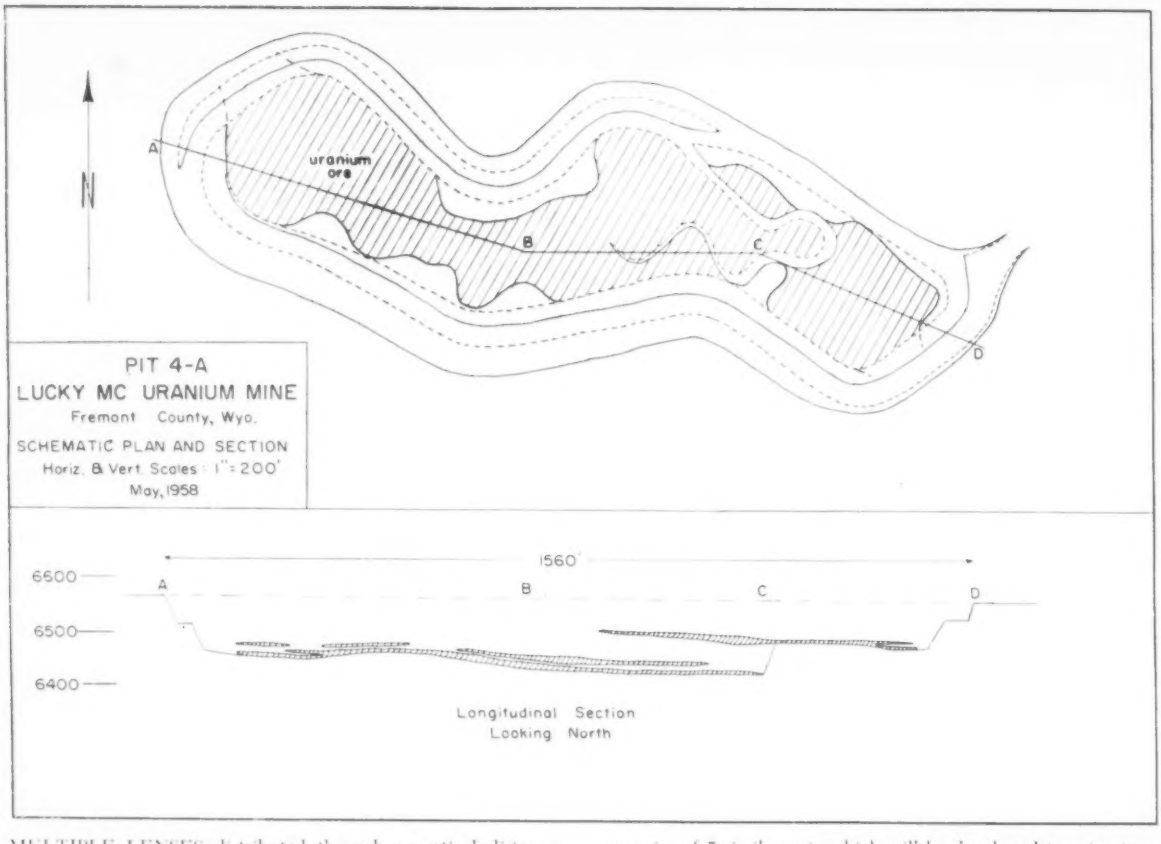
Chairman L. B. Robinson of Consolidated Zinc Corporation Ltd., puts a lot of blame for the lead-zinc fall on the cessation of United States stockpiling last year and uncertainties about United States tariff policies. Mr. Robinson believes that, under the circumstances, it is almost impossible to forecast an improvement in prices. On a brighter note he has said, nevertheless, that it is quite clear that a higher (price) level will be essential to sustain production necessary to meet the continued progress towards a higher standard of living throughout the world. This, of course, is back to the long-term view.

Tin remains the problem child of the major base metals. Swinging restriction of production and exports has now been in operation since the middle of December 1957. By all the statistics, this international plan should now be showing some results in terms of the market price.

The sudden growth of supplies from Russia and, to a lesser extent, China has been the obvious major factor in the setback so far. Some United Kingdom observers do not calculate that this can go on indefinitely and that sales from Russia have been coming more out of stocks than from current production.

There has been a lot of guesswork but there is generally some scepticism about Russia's productive capacity. In the face of this, S. H. Smith of British Tin Investment believes that the steps taken by the International Tin Council will lead to a rise in the price within the next few months.

These are both voices of the producers. The consumer cannot be too unhappy at the present time.



MULTIPLE LENSES distributed through a vertical distance of 150 to 250 feet are typical of two-thirds the length of Lucky Mc's mineralized belt of uranium ore. Pit 4A above is typical of a series of 5 similar cuts which will be developed to extract ore from an S-shaped channel. It will be joined on the northwest and southeast by other open pits.

Rigid Ore Control Yields . . .

Maximum Extraction and Minimum Dilution of U_3O_8 Ore at Lucky Mc's Open Pit Mine in Wyoming

A casual observer's first reaction to Lucky Mc Uranium Corporation's five open pits, 50 miles east of Riverton, Wyoming, would probably be summed up by the terms—big and deep. By far the most outstanding feature, however, is the manner in which operations are tailored first for a fast stripping schedule using tractors and scrapers, to be followed later by selective mining under a unique but strict ore-control program.

The above mix of production techniques is necessary for several reasons. Bulk handling of overburden is a must because the stripping ratio is amazingly high over many of the ore bodies. Now about 25 yards of overburden to a ton of ore, this ratio may go up to 45 yards per ton to recover some of the deeper lying deposits.

Efficient extraction of ore, occurring in a wandering 600-foot-wide channel buried 50 to 80 feet beneath the surface, would be nearly hopeless unless selective mining were practiced. Many of the mineable deposits are found in lenses which are erratic in distribution and grade. The lenses pinch, swell, split, and undulate. On the basis of exploration drilling, many uranium lenses appeared to show reasonable continuity, but, when exposed, just the opposite condition prevailed.

To implement selective mining, the novel ore control system was developed, not only to govern production activities in the pits, but also for proper dispatching of ore trucks to appropriate stockpiles serving Lucky Mc's new uranium mill. The variable uranium content of many of the ore lenses is one factor that prompted development of ore-control measures. But perhaps even more important is the fact that a great deal of ore is out of equilibrium. Separation of ore from waste in many areas, by either visual or radiometric methods, is unreliable.

The essential features of Lucky Mc's program in Wyoming's important Gas Hills District involve several ingredients.

Exploratory drilling on 50- to 100-foot centers outlines the ore bodies. Radiometric or chemical assays yield results on which preliminary mine

PRE-MINE STRIPPING may require shovels if working area is confined or overburden is hard; in this situation a 2½-yd. Northwest shovel and 15 yd. Euclid trucks (above) are used.

MOST OVERBURDEN is handled by tractor-scraper units until 5 feet above ore. Caterpillar DW 20, 18-yd. scrapers and MRS-Wooldridge 20-yd. scrapers are deployed on this job.

planning is based. When the pit outline has been determined, large capacity stripping equipment is moved to the site.

Pre-mine stripping is carried down to a level about five feet above the upper ore horizon. This work is carried out with 18- and 20-yard tractor-scraper units which follow scarified tracks made by rippers mounted on tractors. This equipment is standard in the larger pits under development. Where ground is hard or in the confined areas of pits, 2½-yard shovels are used for stripping. They load 15-yard rear-dump trucks. Development during this period is carried out on a 2-shift per day basis. When development approaches a plane five feet above the ore, the equipment is moved to another site.

Ore-control drilling is then started at the bottom of the pit to firmly establish the characteristics of the deposits within the confines of the pit. Holes are collared on 35-foot centers; under some situations this spacing may be reduced to 17-foot centers. Samples are collected for every foot of hole, and they are checked either chemically or radiometrically, depending on local conditions of oxidation. The information collected during ore-control drilling is used to prepare assay maps, detailed maps of ore bodies for elevation control, and even equilibrium contour maps.

Mine stripping starts immediately following ore-control drilling to remove the waste material remaining above and between ore horizons. Operations during this phase of development are under the direct supervision of an ore-control engineer and several assistants. These men are armed with Geiger counters and the detailed maps described above. The equipment employed for mine stripping is generally

HIGH STRIPPING RATIO over ore that is erratic in distribution, grade and equilibrium required a blend of bulk stripping and selective mining. In above picture a MRS-Wooldridge unit is push-loaded by a Michigan model 480 bulldozer.

TYPICAL ORE MINING is carried out with front end loaders equipped with rippers. In harder ground a 1½-yard Northwest shovel may be used. The units in the above picture consist of an Allis Chalmers HD 16 loader and a Kenworth truck.

TRUCK DESTINATION is determined at probe tower located near exit of each pit. The load may be routed to any one of 3 stockpiles or to waste. Eberline instrument used above returns direct reading of U_3O_8 content on Kenworth truck.

1½-yard shovels or front-end loaders and 8-10 yard trucks. In some instances mine waste stripping can be done with the tractor-scraper equipment used for pre-mine stripping if the top of the ore horizon is uniformly flat.

Mining follows the first exposure of ore. For visual guidance of equipment operators, the ore-control bore holes are continually staked with colored streamers. Various colors indicate whether assay results showed ore or waste at the particular elevation on which work is taking place. When ore is first exposed, the spot is immediately flagged. An ore-control technician remains almost constantly with each of the production units in the pit. In the large mines, where multiple horizons are involved, three to five pieces of equipment may be scattered around the bottom of the pit loading ore; another two or three pieces of equipment may be employed on mine-waste stripping.

A probe tower is established at the entrance to each pit. All trucks stop at the tower. Here a shift operator probes the loaded truck bed and dispatches the truck to the appropriate stockpile. Stockpiling is carried out in a manner so that ore of questionable grade is stored separately until chemical assays are available.

The net result of Lucky Mc's mining plan has been maximum extraction of ore with minimum dilution. The close supervision of ore-control engineers has resulted in recovery of many isolated pods and stringers of ore which might have gone unnoticed. The particular blend of equipment and methods has enabled the company to strip large quantities of overburden to recover ore. With the exception of Lucky Mc's method of ore-control, the operation is similar in many respects to other large-scale operations in Wyoming. It is no exaggeration, however, to say these Wyoming operators have pioneered new and basic concepts in their approach to mining plans. By the time they are finished, standard texts on mining practice will require considerable revision.

Utah Construction Company as a result of the original negotiations owns 60% of the outstanding stock of the owner company, Lucky Mc Uranium Corporation. Lucky Mc exercises supervision and control over the entire mill and mine operations, contracting with Utah Mining Corporation and Utah Development Company for the operation of the mine and mill respectively. Lucky Mc handles all exploration and pit planning. Utah Mining and Utah Development are wholly owned subsidiaries of Utah Construction Company.

Today, Lucky Mc is the largest uranium producer in Wyoming. It can boast a brand new 750 ton-per-day mill, which is one of the most unusual in the United States. Mining activities for 1958 are geared for the removal of 5,000,000 yards of overburden. Lucky Mc has mined, on a large scale, some of the highest grade ore in the state. Unusual equipment and methods have been pioneered at Lucky Mc Development of this important property is a real tribute, not only to the discoverer, but to the staff which explored and established the efficient methods now in use.

The Ore: It Poses Grade Control Problems

The known ore zone now covers a north-south length of nearly 8,000 feet. It is contained in the Wind River formation where it was apparently concentrated in old stream channels. It is most generally associated with loosely cemented sandstones. Other rock types making up the Wind River formation are conglomerates, mudstones, and shales. The most important uranium minerals are coffinite and uraninite.

The ore at the northern end of the property occupies a channel approximately 2,800 feet long by 600 feet wide. It is essentially a blanket-like deposit, and has been designated the Project 1 zone.

The ore of the southernmost two-thirds of the mineralized belt occupies a meandering "S" shaped channel. This area is termed the Project 4 zone. Like the ore at the northern end, the channel is about 600 feet wide. Its north-south length is about 4300 feet, but if the channel trend is followed it would measure over a mile in length. Uranium in the Project 4 area is found in a series of multiple lenses through a vertical distance of 150 to 250 feet. Some lenses measure up to 1,000 feet in length; others are short, and may only be a few tens of feet in diameter. Thirteen known ore horizons have been identified in the Project 4 area, though not all of these layers are found within the confines of any one pit. The Project 4 area contains most of the ore reserves and the highest grade ore. The approximate distance from center to center of the Project 1 and 4 areas is 6,500 feet.

Project 5 zone lies between Projects 1 and 4. This 3,700-foot-long meandering zone probably represents a faulted extension of the Project 1 area. An east-west trending fault crosses the southern end of Project 1. Dis-

placement along the fault is thought to be nearly 100 feet. The south side has been down-thrown relative to the north side.

Both the Project 1 and Project 4 areas are covered by 50 to 80 feet of overburden. In general, the ore horizon of Project 1 is located at the water table, while the lenses in Project 4 are below the water table. Local conditions of oxidation and leaching and redeposition of uranium minerals, therefore, are far more severe in the Project 1 area. The net result is that this ore is in a widely variable state of equilibrium. Radiometric assays yield high returns that are unreliable. The chemical assay is the only method that yields a true indication of the uranium content of ore in the Project 1 area. Continuing studies, however, are uncovering clues that might possibly be used to develop corrective factors for some of the radiometric assays of Project 1. Contour maps of equilibrium areas in Project 1 are very helpful for ore-control work. All ore reserve calculations in Project 1 must be based on chemical assays.

Radiometric assays are far more reliable in the Project 4 area. The bulk, but not all, of the ore in this zone is in equilibrium. Frequent comparison of radiometric and chemical analyses of Project 4 ore yields data necessary for correcting radiometric results. Most of the Project 4 ore reserve calculations are based on radiometric methods.

Lucky Mc Pits Will Join as Work Progresses

To mine the ore contained in the Project 1 area, a total of four open pits will be developed in sequence from the southern end. Each will be stripped and mined separately. They will be joined, however, as work progresses, making one long open cut over ½-mile in length. Two open pits have already been developed in the Project 1 area. They were designed with a maximum wall slope of 70°, since they will be relatively shallow (50 to 80 feet) and the wall rock stands well. Haulage roads out of the developed pits are on a maximum 6.0 percent grade.

In the relatively smaller pits of Project 1, both consolidated and loosely consolidated rock types are encountered. Consequently stripping is carried on by the use of scraper equipment in the softer portions, and, in the harder formations, by the use of 2½-yard, model 80-D Northwest shovels loading into 15-yard end-dump Euclid trucks.

Ore control is a real problem at Project 1 since neither visual nor radiometric guides are reliable. Furthermore, the ore in Project 1 is low-grade and closer to the cut-off point. From the pre-mine strip level down, stripping and mining in areas where ore is out of balance is usually governed by elevation control. This is established based on depth of intersection of ore during ore-control drilling, and requires frequent transit checks by engineers. Below the stripping level, the ore is usually removed in slices which attempt to follow the contour of the ore horizon.

Two fully developed pits have been opened and are prdoucing ore from the Project 4 area. Ultimately five pits will be required to fully extract the ore. Like the Project 1 area, the pits in Project 4 will be joined.

RUBBER-TIRE BULLDOZER shown above is a Michigan 480 which weighs 55 tons and is powered by a 600-horsepower engine. It is capable of push loading a tractor-scraper unit alone where normally two track-mounted machines are required.

Operations in Project 4 are far more spectacular. Some of these pits will go down to a depth of nearly 200 feet below the flat surface of the area. They were designed for a maximum wall slope of 70°. They are benched back 20 feet at the base of the alluvium which is roughly 20 feet thick. Entry to the pits is by spiral haulageway with a maximum grade of 6 percent. Catch benches are provided at points of stratigraphic weakness. One of the most amazing features of Gas Hills operations is the way the walls hold up. Sloughs are rarely experienced, even during periods of heavy rain or snow run-off. They are easily controlled by widely spaced catch benches.

Over 90 percent of all the waste material at Lucky Mc can be loaded by scraper after it is ripped. Only about 5 percent of the rock, occurring in isolated seams and ledges, must be

blasted to facilitate handling. Stripping equipment at Project 4 includes five Caterpillar DW 20 units equipped with scrapers which haul 18-yard payloads; and five MRS tractors which power Wooldridge scrapers capable of carrying 20-yard payloads. or close quarters or tough digging, the 2½-yard Northwest shovel may be employed.

The tractor-scraper units are normally push-loaded with two Allis-Chalmers HD-21 tractors. An experimental Michigan, Model 480, rubber-tired bulldozer is being tried for push loading. This latter unit is powered by one, 600 horsepower Diesel engine, weighs 55 tons, and dwarfs practically every piece of equipment in the mine. Preliminary studies indicate that the single Michigan is capable of push loading any single unit of the scraper equipment. Normally, two tandem bulldozers are required.

Mining and mine stripping at Project 4 is carried out with Allis-Chalmers HD-11 and HD-16 front end loaders. Two 1½-yard Northwest and one, 1½-yard P&H shovels are available for tougher digging conditions. Ore is hauled by Kenworth 8-yard or Euclid 15-yard trucks.

KOEHRING CRANE is a utility unit used at Lucky Mc; here it is equipped with a clamshell for excavating a sump.

All ore trucks coming out of the Project 4 open pits stop at a probe tower constructed near the exit of the pits. Here a shift worker, equipped with an Eberline instrument containing a 3-foot long probe, spot checks the load in several spots. His instrument is calibrated to return a direct reading of the uranium content and he then dispatches the truck to the appropriate destination according to the company's uniform system of ore classification.

All rock taken from the open pits falls into one of the four categories outlined below:

1. Milling grade.
2. Low-grade 2
3. Low-grade 3
4. Waste

The milling grade ore is stockpiled at an area adjacent to the mill which has been cleared and leveled for that purpose. Two stockpiles are being built at all times. Trucks bearing milling grade ore dump their load in windrows on either of the two stockpiles. After the base area of a stockpile has been completely filled with windrows of ore, the surface is bladed smooth with a bulldozer which also builds a ramp of ore for subsequent truck traffic to the stockpile. On any of the stockpiles, alternate layers of low-grade and high-grade, mill-run ore are dumped and then spread flat. Finished stockpiles are reclaimed with a rubber-tired front end loader which works at right angles to the direction in which the windrows were originally formed. In this manner, a well blended and uniform feed for the mill is obtained.

The low-grade 2 ore classification was established to provide interim storage for questionable or marginal

These Men Are Responsible For Discovery,

Neil McNeice is a quiet, soft-spoken, mild mannered mechanic and you'd never suspect that he is on the board of directors of one of the most important uranium companies in the world. Yet he's made of the fiber on which this country was built. He is the man who first discovered ore in the Gas Hills of Wyoming. He is the man who laid the foundation on which Lucky Mc Uranium Company was formed.

His story is a fascinating one. Picture this: a garage mechanic who finally saved enough to open his own general repair shop; a man who loved the outdoors and nature; a man who was naturally interested in minerals and who was quite a rockhound. Neil visited Charlie Steen's mine in 1953 and that's where he got the idea that there was uranium in the Gas Hills.

Neil is not an ordinary prospector. He has searched for minerals all over the state of Wyoming—Dubois, South Pass, the Snowy Range near Laramie, Copper Mountain north of Lander, southern Wyoming, and the area west of Rawlins. In the winter of 1948 he purchased a $50 Detectron Geiger counter. The day he first set foot in the Gas Hills, however, he made his first great discovery.

Neil had nothing in his favor during the grim period that followed while he tried to explore and develop his strike. He was the recipient of a lot of bad advice. His strike was belittled by many because the AEC had flown the Gas Hills prior to his discovery, later had checked some of the anamolies on the ground with discouraging results. But he had undying faith in what he had found. Even more important, he had an intense desire to develop a legitimate mine, was not even remotely interested in rigging a stock market promotion.

Neil poured money into his prospect—a lot of money for him. His business suffered and he borrowed to the hilt on his insurance. He and his partner, Lowell Marfeld of Riverton, struggled to keep the infant operation alive. R. L. Moran, a Riverton lawyer advising them on legal matters.

Half a year later several people had been in to look at the property, but little concrete progress had been made. Finally W. H. H. Cranmer, president of New Park Mining Company, became interested in the property. He took an option with a right for participation in the venture, and sent up experienced geologists. After some preliminary work it became evident to Mr. Cranner that an extensive deposit was indicated and that a mill was needed. Some 70,000 to 80,000 tons had already been blocked out. But New Park just wasn't in a position to handle the undertaking. Neil McNeice then gave Utah Construction Company an option to drill and an option to develop. At the time Neil was saddled with a huge debt, and when Utah asked for a time extension, he really began to sweat.

The story had a happy ending, however, because Utah eventually exercised the option, built a mill, and developed the deposits. What about Neil? He's on the board of directors, but more than likely you'll find him in a pair of dungarees talking to the boys at his repair shop. Will he continue prospecting? "Just as long as I'm physically able to get into the hills," said Neil.

ore. All stockpile destinations from Project 4 are determined on the basis of radiometric assays at the probe tower. These checks may be inaccurate and it's possible that a load which radiometrically assays near the mill cut-off point could be incorrectly shunted to either the mill stockpile or to the low-grade 3 classification.

Regular grab samples of the low-grade 2 windrows are taken for chemical analysis. If the return shows that it is ore, then it can be reclaimed with a minimum of expense and time. Past experience has shown that about 20 percent of the marginal ore sent to low-grade 2 has been recovered as a product grading above the cut-off point.

The low-grade 3 classification was conceived as a means of separating sub-grade material from waste which is barren of uranium. This is simply a form of insurance and a means of conservation of resources pending changes in future economic conditions. There may be a day when it would be feasible to treat this material in the mill. If it were sent to the waste dumps, it would be lost forever.

Most of the ore is at or under the water table so provisions are necessary to keep the pits de-watered. By a system of drain ditches, sumps and intermediate pumps, all water is drained to a central sump. A gasoline-powered Fairbanks Morse or Jaeger high pressure, centrifugal pump then delivers the water from the sump to a surface canal surrounding the pit perimeter.

BLASTHOLE WORK required at Lucky Mc operations is very minor in amount; only about 5 percent of the ground must be blasted before it can be loaded. The above picture shows the MRS-Wooldridge scraper and Michigan pusher.

Mining results at Lucky Mc have been most satisfactory to date. It is evident that well planned exploration, and development have been instrumental in devising the selective mining system in use.

THE END

Development and Operation Of The Lucky Mc

A. V. Quine, General Manager of Lucky Mc, was hired in 1956 after Utah construction had exercised its option. He manages and directs the entire operations of the mine and mill, having acted as owner representative in controlling the construction of the mine and mill facilities while under contract to Utah Development Company and acts in the same capacity in the present mine and mill contracts with Utah Development Company and Utah Mining Corporation.

John Anderson manages Utah Mining Corporation and Utah Development Company. He has sparked the application of new methods and has encouraged original thinking on the part of his staff on the many mining and processing problems.

R. P. Porter, Lucky Mc consulting metallurgist, whose vast knowledge and experience in uranium milling was greatly responsible for the unusual design and successful operation of the milling plant.

H. J. Rowe and his capable staff, Project Construction Manager for Utah Development Company whose untiring efforts enabled the mill to be brought "on stream" several months ahead of schedule despite severe weather setbacks.

S. A. (Hoppy) Hottman, Mine Superintendent, whose dirt moving abilities require no further commmendation than the record produced.

Ian Ritchie, mill superintendent, came to Lucky Mc via Canada's Algom Quirke and South Africa. He's a young man, but has a wealth of experience in uranium processing.

Art Gaines and **"Rusty" Mclure,** mechanical wizards who keep the wheels turning.

Don Anderson, formerly a geologist with New Park, contributed a great deal to the development of Lucky Mc. He was sent up from Salt Lake City, is now chief geologist for Lucky Mc. Don is a dedicated geologist—the kind of a man who goes down a 24-inch rat-hole in a bosun's chair to wall sample a bore-hole and to get a first-hand look.

John Atkins, Utah project engineer, and **Charles Spielman,** assistant to Don Anderson who look after the implementation of pit design and its coordination with mine operation.

John S. Bailey, Utah's local Exploration Manager whose long hours of work and planning in conjunction with the original Lucky Mc personnel brought the ore reserves to such a successful conclusion. He was instrumental in helping to develop the technique of frozen-core drilling as applied to uranium deposits.

Harold Pitts, chief chemist, supervises the hundreds of assays channeled through his modern up to date laboratory each month.

Many others contributed their skill and knowledge such as **J. A. Mecia,** Utah Construction Company vice-president—Lucky Mc managing director and his capable assistant, **A. M. Wilson** besides the unsung heroes of the design department of Utah including **Rodney H. Hunt,** chief design engineer and his many able assistants such as **Fred L. Calkins, E. F. (Pat) Nelson,** and **J. P. Bowman.**

U. S. Experts

Report on Soviet Iron Ore and Steel

- **Reserves are probably larger than any other country in the world, but most deposits are low in grade.**
- **Steel output is growing by leaps and bounds and present capacity is slated to more than double by 1975.**
- **Reds have nothing now to compare with Erie or Reserve, but beneficiations techniques are well advanced.**
- **Technicians have shown remarkable aptitude for copying the better U. S. equipment designs and practices.**

Russia has made huge strides in building its steel industry, according to a preliminary report issued by a 19-man delegation of United States iron ore and steel industry representatives who recently completed a one-month tour of Soviet producing facilities. The report, published by the American Iron and Steel Institute, termed the Soviet steel industry as the largest steel operation in the world under a single management. Ore reserves were described as vast; and plants were called modern, efficient, and well managed.

Among the United States delegation making the trip and reporting observation were: Edward L. Ryerson, director and former chairman of the board, Inland Steel Company; John A. Stephens, vice president, United States Steel Corporation; Everett L. Joppa, general manager, Lake Superior Iron Mining Division, Pickands Mather & Co.; Dmitri N. Vedensky, director of research and development, The M. A. Hanna Company; and Col. Merle R. Thompson, secretary, Committee on Foreign Relations, American Iron & Steel Institute.

Though the report of the American group is only preliminary, it contained several interesting observations.

Iron ore reserves of the Soviet Union are most impressive. Total proven reserves have been established at 35,900,000,000 metric tons with an average iron content of 37 percent. Direct shipping ore not requiring beneficiation was placed at 5,000,000,000 tons, with an average iron content of 55 percent. Easily beneficiated ore amounts to 19,600,000,000 tons with an average iron content of 31 percent. This latter category includes magnetite-bearing quartzites similar to Minnesota taconites. Ores difficult to beneficiate comprise 11,300,000,000 tons with an average iron content of 36 percent.

Soviet Iron Ore Production and Reserves In Metric Tons By Districts*

Deposit or Region	*1955 Production*	*Percent of Total*	*1965 Planned Production*	*Percent of Total*	*Proven Reserves*	*Percent Iron*
			WEST			
Tulla and Lipetsk	1,530,000	2.1	1,620,000	1.0	102,000,000	41.5
KURSK (KMA)						
Rich ore	—	—	2,160,000	1.4	634,000,000	54.0
Quartzite	250,000	0.4	3,710,000	2.3	2,227,800,000	33.0
KRIVI ROG						
Ore	36,810,000	51.2	49,210,000	31.0	1,592,500,000	57.3
Quartzite	370,000	0.5	14,390,000	9.0	6,548,500,000	38.0
Kerch	2,770,000	3.9	9,400,000	5.9	1,638,300,000	37.2
Other Western	1,230,000	1.7	6,650,000	4.2	982,000,000	—
TOTAL IN WEST	42,960,000	59.8	87,140,000	54.8	13,745,300,000	—
			EAST			
Magnitogorsk	12,190,000	17.0	9,540,000	6.0	300,000,000	50.5
Baikal Region	4,030,000	5.6	5,360,000	3.4	208,500,000	37.9
Kachkanarsk	—	—	4,960,000	3.1	3,900,000,000	16.7
KUSTANI						
Magntite	240,000	0.3	12,310,000	7.7	1,536,900,000	46.5
Bog ore	—	—	2,380,000	1.5	3,368,900,000	36.8
Western Siberia and Abakan	3,620,000	5.1	12,310,000	7.7	1,536,900,000	46.5
Other Eastern	8,810,000	12.2	28,380,000	18.6	3,584,600,000	—
TOTAL IN EAST	28,910,000	40.2	70,630,000	45.2	13,338,300,000	—
TOTAL IN USSR	71,870,000	100.0	158,770,000	100.0	27,083,600,000	—

* These data are compiled from "The Iron Ore Base of the Iron and Steel Industry of the USSR," edited by Professor Ivan Pavlovich Bardin, vice president, Academy of Sciences of the USSR, Moscow, 1957, pages 548, 549 and 464 to 468. Since January 1956, the estimates of iron quartzite reserves have greatly increased.

Average iron content (37 percent) is lean but compares favorably with the United States, and is higher than ores of Western Europe (France 29 percent, West Germany 30 percent, and Great Britain 28 percent iron). Most West Europe ores, however, are self fluxing. Many of Russia's iron deposits are low in iron content and high in silica. Some have an objectionably high zinc content. Others are contaminated with arsenic.

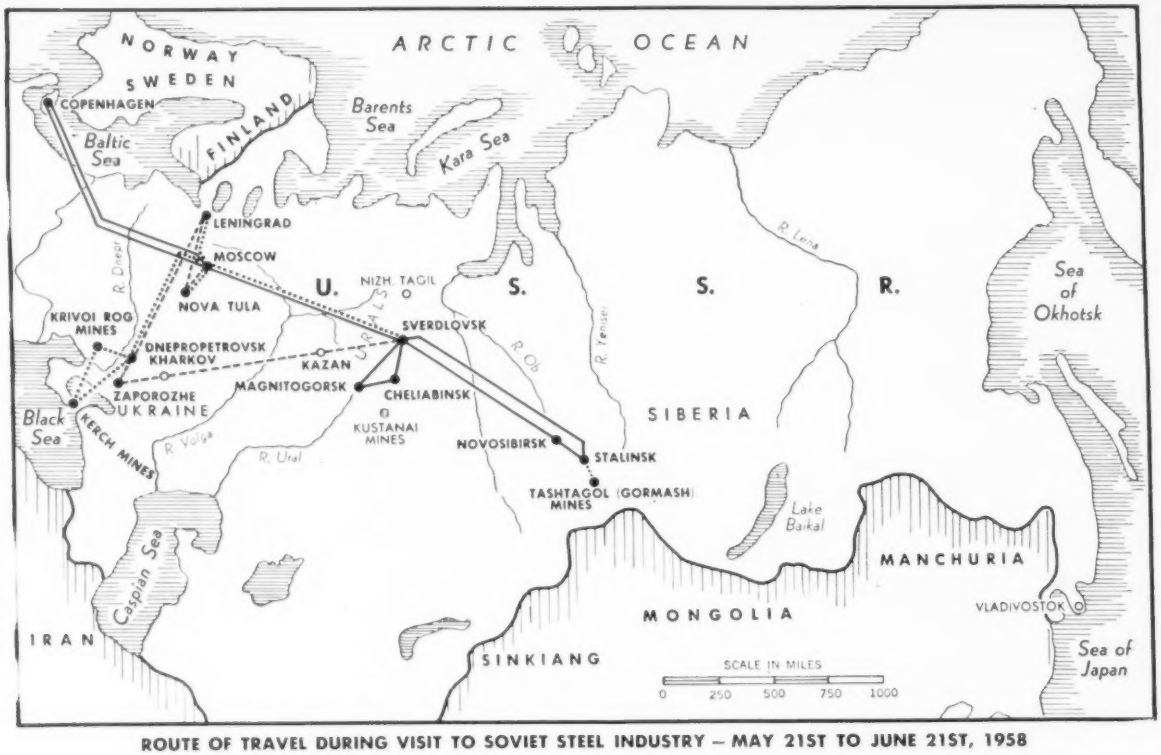
Expansion plans of the Soviet steel industry are extensive and cover a long range. It is significant that Soviet steel capacity, badly battered in World War II, has tripled in the past 10 years to 60,000,000 net tons of ingots. The goal for 1960 is a producing capacity of 70,000,000 net tons, and for 1975 the target is 125,000,000 net tons of ingots. Steel making capacity in the United States at the start of 1958 was 140,742,250 net tons of ingots.

Processing. It should be noted that the Soviets have installed extensive beneficiation and sintering facilities which convert many of the low-grade ores into satisfactory material for charging into their blast furnaces. Such extensive efforts to rectify raw material disadvantages have not only succeeded, but have also contributed noteworthy improvements in blast furnace production of pig iron, the vital base of Soviet steel making.

In beneficiation processing, Russian techniques are advanced, but few large-scale plants have been built. Plans are underway, however, to construct new magnetic concentrating plants with a combined annual capacity of 30,000,000 metric tons of ore concentrates.

Iron-silica ratio of the ore fed to blast furnaces is in general higher than in the United States. Of the Soviet blast furnace plants visited, only Magnitogorsk (capacity 6,600,000 tons of ingots per year) had an iron-silica ratio comparable to United States ores. The other Soviet ores would not be considered acceptable to our furnaces.

Supervisors at ore beneficiation plants are well-trained, and familiar with equipment and the planned solutions to current operating problems. They are also well informed of American practices. The number of men actually manning Soviet and American ore mining and beneficiation equipment is about the same. Russian maintenance departments employ considerably more personnel; maintenance is stressed as a means of getting all pos-



ROUTE OF TRAVEL DURING VISIT TO SOVIET STEEL INDUSTRY – MAY 21ST TO JUNE 21ST, 1958

——— BOTH GROUPS — — — STEEL GROUP ..... MINING GROUP

LOCATIONS of important mines and plants visited by U. S. group are shown on map. In addition to efforts to improve beneficiation of low-grade ores, Russia is striving to increase the output of high grade at Krivoi Rog, Kursk, and other areas; new open-pit and underground mines with output of 15,000,000 tons per year are planned for Kursk area.

sible production. Serious abrasion problems still exist. For example, they have not developed the technique for rubber-lining pumps, and the life of their pumps is seven to eight days before complete overhaul, compared to six months for similar American pumps.

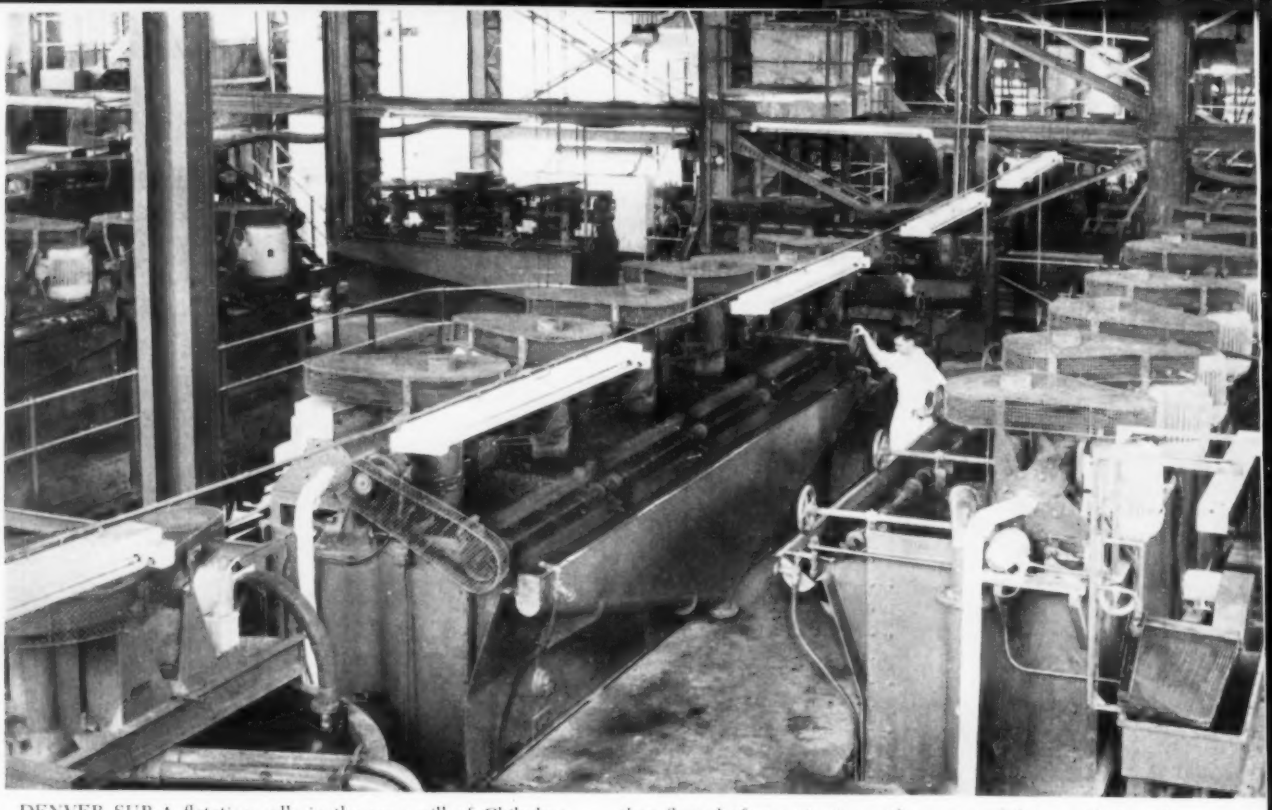
Sintering. On the average the Russians are feeding more sinter to blast furnaces than the U.S. does, and getting more furnace production as a result. The practice is to use 60 to 100 percent sinter in the blast furnace burden. Soviet sinter is self-fluxing since limestone is mixed with coke and ore before the mixture is fused. This is something that the United States operators are not yet doing. Though the Russians are completely sold on sintering, they have, until now, been slow to build the very large sintering machines which have proven efficient in America.

Research is considered of great importance to the iron ore and steel industry of the Soviet Union. Particularly impressive is the way that the management quickly disseminates information on new developments, and sees that improvements are adopted at all plants where they are applicable. Equipment and instruments seen in use were mostly conventional in type and of Soviet make.

Research activities are concerned with the whole field of concentration and agglomeration of ores. Mobile equipment has been built for sampling and analyzing for use in field exploration and in mining operations. Other studies include the effect of flotation reagents on mineral surfaces and structure of ores (the latter including microscopic work at 10,000 to 20,000 magnification). Experimental work is being conducted on direct reduction of iron ore, but they do not expect such a process to make blast furnaces obsolete. A design section in a research institute is at work designing a large beneficiating plant to treat very lean ores having only 16 to 18 percent iron.

THE END

AMERICANS at Mechanobr Research Institute are left to right: E. C. Smith, Republic Steel Corporation; F. M. Rich, Inland Steel Company; K. C. McCutcheon, Armco Steel Corporation; Prof. M. G. Clark, Cornell University; and interpreter.



DENVER SUB-A flotation cells in the new mill of Chibuluma Mines Limited in Northern Rhodesia. Copper is floated first with Aerofloat 208 and methyl isobutyl carbinol while cobalt is depressed with lime and sodium cyanide. Cobalt minerals are then floated after activation with copper sulphate, acidation of the pulp with sulphuric acid, frothing with pine oil, and use of sodium isopropyl xanthate as a collector. Denver No. 30 and Denver No. 30R cells are used in two circuits.

How Chibuluma Floats Copper-Cobalt

By J. E. HARPER

Chibuluma Mines Limited has the distinction of having the highest grade of copper ore and the lowest copper costs per pound of the Rhodesian Selection Trust group of mines in the Copperbelt of Northern Rhodesia. American Metal Climax, Inc. owns approximately 32 percent of the Rhodesian Selection Trust.

Ore grade and reserves have been estimated as 5.23 percent copper, 0.25 percent cobalt, and 7,300,000 tons. For the fiscal year 1957, Chibuluma's average cost of producing blister copper was 15.5 cents per pound.

Approximately £6,000,000 ($17,000,000) was required for developing and equipping the Chibuluma mine and of this sum £5,000,000 was advanced on loan by the General Services Administration of the United States government. Chibuluma is permitted to deliver up to 5,500,000 pounds of cobalt to the United States government in repayment of this loan. In the first year of operation, 1,962,000 pounds of cobalt were recovered. From March 1, 1956 to December 31, 1957, 37,199 tons of copper were produced. Initial profits in the first 16 months of operation will meet accrued loan interest and reduce the debt to about $11,200,000.

Mr. Harper is concentrator superintendent, Chibuluma Mines Limited, Kalulushi, Northern Rhodesia.

Test Ore, Design Mill

The economic minerals present in the Chibuluma ore body are principally chalcopyrite ($CuFeS_2$), linnaeite (Co_3S_4), and cobaltiferous pyrite, while the gangue is chiefly quartzite. Preliminary tests on samples from the drill cores indicated that the ore was amenable to differential flotation. When sufficient ore was available from mining operations, an extensive program of metallurgical investigations was commenced. Initially all the work was performed in a laboratory, but later a one-ton-per-hour pilot plant was constructed. Many flowsheets and flotation reagent combinations were tested in this pilot plant, which was operated 24 hours per day for a year. The results of these investigations enabled the final flowsheet to be prepared and the design of the concentrator to be completed.

The concentrator was designed to treat 40,000 tons of ore per month and was commissioned on March 1, 1956. The usual troubles experienced

during the initial running-in period were soon overcome and the experience gained with the pilot plant enabled high recoveries of both copper and cobalt to be obtained with only minor modifications to the flowsheet.

Primary Crushing

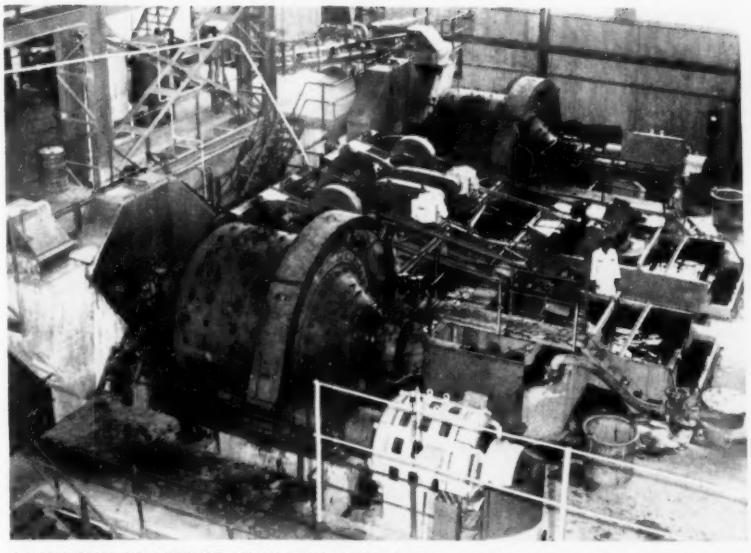
All crushing is carried out on surface. The primary crusher is a 36- by 48-inch Blake type jaw crusher housed in a reinforced concrete chamber beneath the coarse ore stockpile. The entrance to this chamber is on ground level, but the crusher is 20 feet lower. After constructing the crusher chamber and the reinforced concrete tunnel for the conveyor handling the crushed product, 20,000 tons of waste rock from underground development were dumped over these structures to form a truncated conical pile. When plant operations commenced, waste rock was drawn through the hopper set in the roof of the chamber and fed to the crusher. The space which remained after crushing the waste rock is used for coarse ore storage and has a capacity of 2,000 tons.

The ore is hoisted to surface through an inclined shaft in 8-ton-capacity skips delivering to a 200-ton steel bin in the headframe. This bin is discharged by a variable speed Ross chain feeder and the ore is delivered by an inclined belt conveyor to the 2,000-ton stockpile. This belt conveyor is equipped with an electronic metal detector set to sound an alarm when tramp iron of a size likely to damage the primary crusher passes through the detector fields.

The jaw crusher is fitted with water cooled white metal bearings. Alarms indicate a drop in water pressure and overheating of the water. In addition, a resistance thermometer and a thermal switch are fitted to each of the main bearings, the former being connected to a recording thermometer and the latter is arranged to trip the crusher in the event of the bearings overheating.

Secondary and Tertiary Crushing

The jaw crusher product is delivered by an inclined belt conveyor to a steel bin of 600 ton capacity. This bin is discharged by a variable speed apron feeder onto a belt conveyor delivering to a Gyrex double-deck screen. The top deck consists of a cast manganese steel plate with 2½-inch-square holes, while the bottom deck is of ¾- by 1¼-inch flat weave screening. The oversize from both decks passes to a 5½-foot Symons Standard cone crusher, while the undersize is delivered by belt conveyor to the fine ore storage bins in the grinding section. The crusher is set to give a minus-1½-inch product.



GRINDING-CLASSIFICATION CIRCUIT has a capacity of 2,000 tons per day. Ball mill discharge, 75 percent solids, flows to classifier which overflows 35 percent solids for flotation feed.

The discharge from the Symons Standard crusher is delivered by belt conveyors to a steel storage bin of 300 ton capacity. Ore is discharged from this bin by two vibrating feeders delivering to two Symons Rod Deck screens. The screen undersize (minus-¾-inch) is delivered to the fine ore storage bins, while the oversize is fed to a 5½-foot Symons Short Head cone crusher set to give a minus-¾-inch product which is returned to the 300-ton-capacity storage bin.

The conveyors delivering ore to the two Symons crushers have electromagnets suspended over bronze head-pulleys to protect the crushers from tramp iron. The crushers have individual electrically interlocked oil pumps and each crusher is fitted with a pressure switch arranged to sound an alarm in the event of the oil pressure falling below a set figure.

A Merrick Type S weightometer is installed on the conveyor delivering ore to the fine ore storage bins and is connected to a tonnage indicator and recorder which are situated on a central panel in the crusher building.

Grinding-Classification

The grinding section has a capacity of 2,000 tons of ore per day and consists of two identical units. The four fine ore storage bins supplying the two units have a total storage capacity of 2,000 tons. These cylindrical steel bins are hopper bottomed and are discharged by vibrating feeders. One-kilowatt bin vibrators have been fitted to the hoppers to assist in maintaining a regular discharge when wet ore is encountered.

The ore discharged by the vibrating feeders is delivered by belt conveyor to the ball mill feed conveyors which pass over Merrick Type S weightometers. Ore is fed to the two 10-foot by 72-inch-Hardinge conical ball mills by 6-foot radius scoop feeders. Each mill is direct-coupled to a 440-horsepower synchronous induction motor running at 300 revolutions per minute and geared, through single helical gearing, to give the mill a speed of 19 revolutions per minute which is 77 percent of the critical speed. All the ball mill liners are of manganese steel, the wrapper liners being of the grid or pocket type, while the feed and discharge end liners are the solid ribbed type. The ball make-up charge consists of 2-, 2½-, and 3-inch-diameter, white, cast-iron, grinding balls.

The ball mill discharge, maintained at 75 percent solids, flows to an 8- by 30-foot Dorr duplex rake classifier. Classifier sands return by gravity to the ball mill scoop feeder and the classifier overflow is pumped to a distribution box in the flotation section. Rotameter continuous density meters are employed to maintain the density of the classifier overflow at 1.3 grams per cubic centimeter (35 percent solids), which gives a flotation feed of approximately 50 percent minus-200-mesh. To achieve this control, a fraction of the classifier overflow is passed through a pivoted and counter-

balanced loop of stainless steel piping in the density meter. Changes in the density of the pulp disturb the equilibrium and such changes are detected by a pneumatically operated force-balance which gives an output signal in the form of a varying air pressure in the standard instrument range of 3 to 15 pounds per square inch. This air pressure is transmitted to a Foxboro pneumatic recording-receiver-controller which operates the pneumatic Saunders valve controlling the addition of water to the classifier.

The first stage of the flotation process is carried out at pH 10.8 to 11.3. To obtain this pH, a lime pulp is fed to the ball mills from feeders controlled by diaphragm air motors activated by Foxboro pH recording-controllers. These instruments are coupled to Beckman pH meters, the electrodes of which are located near the overflow weir of each classifier.

In the first stage of the differential flotation process, the copper minerals are selectively recovered after depression of the cobalt minerals by lime and sodium cyanide. For the best results the lime must be added to the ball mill and the pH maintained within the range 10.8 to 11.3. The cyanide may be added to the ball mill, but the rate of addition must then be considerably higher than the 0.05 pound per ton of ore milled which is required to give maximum depression when the cyanide is added to the conditioner preceding the copper circuit. To compensate for fluctuating tonnages it is usual to add slightly more than 0.05 pound per ton and this addition is made to the pulp entering the conditioner. Methyl isobutyl carbinol is the frother used in the copper circuit and is also added to the conditioner. This frother is inexpensive, has no collecting properties, and forms a non-gummy froth having the desirable degree of stability and persistence. Many of the other frothers tested were found to have certain collecting properties. Aerofloat 208 (a dithiophosphate) is the selective collector used to recover the copper and is added to the conditioner overflow.

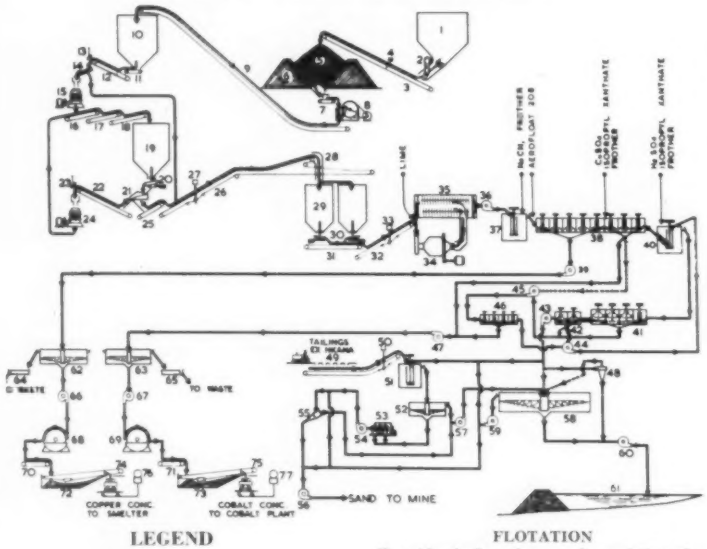
The cobalt minerals are recovered after activation with copper sulphate and the addition of sulphuric acid to lower the pH to 9. The frother used in the cobalt circuit is pine oil and the collector sodium isopropyl xanthate.

The present grinding and classifying practice gives a flotation feed of approximately 50 percent minus-200-mesh, which enables over 97 percent of the copper and 94 percent of the cobalt to be floated. A finer degree of comminution makes little difference to these total recoveries but releases cobalt mineral attached to and entrapped within copper mineral particles. This liberation enables the amount of cobalt reporting in the copper concentrate to be reduced and appears to reach a practical minimum at about 70 percent minus-200-mesh.

The amount of copper reporting in the cobalt concentrate can be varied by altering the number of cells used to recover copper concentrate and also by varying the amount of Aerofloat 208 added. A small diaphragm pump is used to obtain a sample of the feed to the cobalt cells and this is passed over a No. 13A Wilfley table. By observing the comparative widths of the copper and cobalt mineral bands on this table, the amount of copper passing into the cobalt circuit can be controlled.

The flotation separation is controlled to provide cobalt concentrate of the grade required for the subsequent treatment processes. At present this calls for the production of a cobalt

Copper-Cobalt Flotation Mill Flowsheet
Chibuluma, Mines Limited, Kalulushi, Northern Rhodesia



LEGEND

CRUSHING

1. 200-ton capacity bin.
2. Ross chain feeder.
3. 60-inch wide belt conveyor.
4. Electronic metal detector.
5. 2,000-ton-capacity stockpile.
6. Waste rock retaining walls.
7. 60-inch-wide Amsco apron feeder.
8. 36 by 48-inch Blake jaw crusher.
9. 42-inch-wide belt conveyor.
10. 600-ton-capacity bin.
11. 48-inch-wide Amsco apron feeder.
12. 30-inch-wide belt conveyor.
13. 43-inch-diameter electromagnet.
14. 48- by 102-inch Gyrex double-deck screen.
15. 5½-foot Symons Standard cone crusher.
16, 17, 18. 36-inch-wide belt conveyors.
19. 300-ton-capacity bin.
20. Two 48 by 60-inch Locker-Traylor vibrating feeders.
21. Two 60- by 96-inch Symons K Type rod deck screens.
22. 30-inch wide belt conveyor.
23. 43-inch-diameter electromagnet.
24. 5½-foot Symons short head cone crusher.
25, 26. 30-inch-wide belt conveyors.
27. Merrick Type S weightometer.
28. Travelling tripper.

GRINDING

Two identical sections, each consisting of
29. Two 500-ton-capacity bins.
30. Two 18- by 48-inch Locker-Traylor vibrating feeders.
31, 32. 20-inch-wide belt conveyors.
33. Merrick Type S weightometer.
34. 10-foot by 72-inch Hardinge conical ball mill.
35. 8- by 30-foot Dorr D.S.F.X. rake classifier.
36. 5-inch Model K Wilfley pump.

FLOTATION

Two identical sections, each consisting of
37. 10- by 10-foot Denver conditioner.
38. Eight Denver No. 30 standard flotation cells.
39. 2-inch Model K Wilfley pump.
40. 10- by 10-foot Denver conditioner.
41. Four Denver No. 30 flotation cells—one standard, three Type M.
42. Two Denver No. 30R flotation cells.
43. 6-inch Model K Wilfley pump.
44, 45. 2-inch Model K Wilfley pumps.
46. Four Denver No. 18 Special flotation cells.
47. 2-inch Model K Wilfley pump.

TAILING CLASSIFICATION & DISPOSAL

48. 24-inch hydrocyclone.
49. 30-inch-wide belt conveyor.
50. Merrick Type S weightometer.
51. 10- by 10-foot Denver agitator.
52. 30-foot Dorr hydroseparator.
53. Two 6W Dorr diaphragm pumps.
54. 8- by 8-inch Hydroseal pump.
55. Twelve 12-inch hydrocyclones.
56. 6- by 6-inch Hydroseal pump.
57. 10- by 10-inch Hydroseal pump.
58. 100-foot Dorr Type S Torq thickener.
59. 10- by 10-inch Hydroseal pump.
60. 6- by 6-inch Hydroseal pump.
61. Tailing Dam.

CONCENTRATES FILTERING & HANDLING

62, 63. 35-foot Dorr Type S Torq thickeners.
64, 65. Concrete settling ponds.
66, 67. 2-inch Vacseal pumps.
68, 69. 8 by 12-foot Dorr-Oliver drum filters.
70, 71. 20-inch-wide belt conveyors.
72, 73. 200-ton-capacity storage pens.
74, 75. 40 horsepower drag scrapers.
76. Denison 20-ton-capacity weighbridge.
77. Denison 15-ton-capacity weighbridge.

concentrate containing 3 percent copper and 15 percent insoluble material. Both the copper and cobalt are recovered from the cobalt concentrate, but the copper concentrate is treated in a conventional smelter and the cobalt contained in the converter slag.

Arrangement of Equipment

The flotation equipment is arranged in two identical sections which can be fed by either ball mill. Each section may be operated independently of the other and is serviced by separate pumps and automatic samplers. The description which follows is of one section:

From the distribution box the flotation feed flows to a 10- by 10-foot copper conditioner where the sodium cyanide and frother are added. Aerofloat 208 is fed into the circuit at the conditioner overflow weir and the pulp then flows to a bank of eight Denver No. 30 standard flotation cells where the copper concentrate is recovered, usually from the first five cells. This concentrate does not require cleaning and is pumped directly to the filter plant. To prevent the formation of lime deposits in the pipes carrying copper concentrate and filtrate, sodium hexametaphosphate is added to the copper concentrate launder at the rate of 0.01 pound per ton of ore.

Copper sulphate, sodium isopropyl xanthate, and pine oil are added to the overflow weir of the last copper cell and the remaining cells in this bank are utilized to recover cobalt, this concentrate also being pumped directly to the filter plant.

The overflow from the conditioner passes to a bank of four Denver No. 30 flotation cells where a rougher cobalt concentrate is produced which is pumped to the cleaner cells. Three of these rougher cells have been modified by removing the weirs and installing Denver Type M (Myers) impeller assemblies. The standard assembly has been retained in the first cell to provide the pumping action required to ensure positive entry of pulp. A further modification has been the installation of a second froth overflow lip on the motor side of the cells.

Two Denver No. 30R flotation cells are used as scavengers, treating the tailing from the cobalt rougher cells. The concentrate produced by these scavenger cells is returned to the cobalt conditioner, while the tailing, constituting the final tailing, is pumped to the tailing classification plant. These No. 30R cells have been modified by removing the top impeller and reducing the impeller speed. This has not affected the metallurgical efficiency, but has resulted in a considerable reduction in the power consumed.

MODERN MILL in center of African bush. The ore flows from primary crusher in foreground through secondary and tertiary plants at left center and on to grinding, flotation, and filtering in the main mill building shown in background.

Cleaning of the rougher cobalt concentrate is carried out in a bank of four Denver No. 18 Special flotation cells. The cleaner tailing is returned to the cobalt conditioner and the concentrate is pumped to the filter plant.

All the flotation cells, except the first four copper cells and the cleaner cells, are supercharged with low pressure air supplied by a 5,500-cubic-

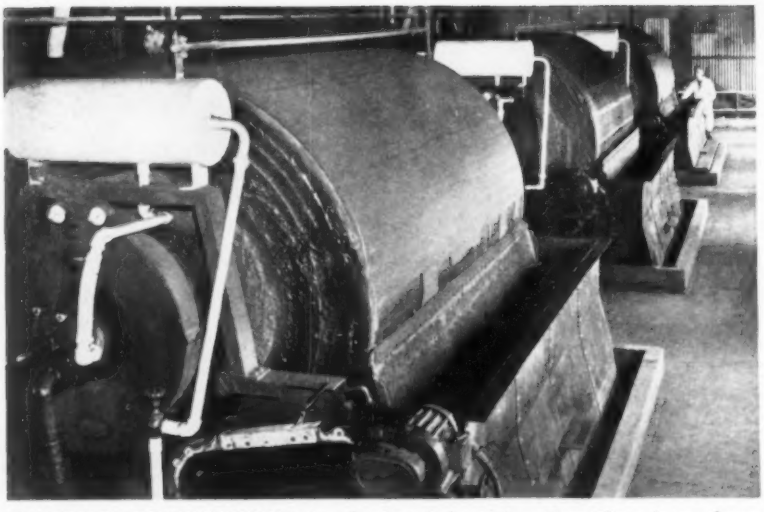
Reagents Consumption, Point of Addition, and Use at Chibuluma Mines Limited's Copper-Cobalt Mill at Kalulushi, Northern Rhodesia

Reagent	*Pounds Per Ton Ore Milled*	*Where Added*	*Use*
		COPPER CIRCUIT	
Lime	2.40	Ball Mills	To obtain 10.8 to 11.3 pH, Depress Cobalt Minerals
Sodium cyanide	0.08	Pulp to Copper Conditioner	Depress Cobalt Minerals
Aerofloat 208	0.07	Copper Conditioner Overflow	Selective Copper Collector
Methyl isobutyl carbinol	0.03	Copper Conditioner, Copper Circuit	Frother
		COBALT CIRCUIT	
Copper sulphate	0.12	Overflow Last Copper Cell, Cobalt Conditioner	Activate Cobalt Minerals
Sulphuric acid	1.31	Cobalt Conditioner	Lower pH to 9.0
Sodium isopropyl xanthate	0.11	Overflow Last Copper Cell, Cobalt Conditioner	Cobalt Minerals Collector
Pine oil	0.02	Overflow Last Copper Cell, Cobalt Conditioner	Frother

Analyses of Typical Products and Percent Copper and Cobalt Recovery at Chibuluma Mines Limited's Copper-Cobalt Mill at Kalulushi, Northern Rhodesia

Percent	*Feed*	*Copper Concentrate*	*Cobalt Concentrate*	*Tailing*	*Total Copper Recovery, Percent**	*Total Cobalt Recovery, Percent***
Copper	4.77	34.6	3.1	0.14	97.6	—
Cobalt	0.37	0.4	4.2	0.025	—	94.6
Iron	—	25.3	33.2	—	—	—
Sulphur	—	31.8	41.6	—	—	—
Insoluble	—	6.2	14.9	—	—	—
Moisture	—	6.8	8.8	—	—	—

* Copper recovery in copper concentrate 93.0 percent; in cobalt concentrate 4.6 percent.
** Cobalt recovery in cobalt concentrate 80.7 percent; in copper concentrate 13.9 percent.



CONCENTRATE FILTERING is done by three 8- by 12-foot Dorr-Oliver drums shown in the picture. Thickened copper and cobalt concentrates flow to filters. Cake drops to belt conveyors for delivery to concrete bins.

foot-per-minute Demag blower.

Reagent Handling

The sodium cyanide solution is prepared in a separate building and delivered by compressed air to the feeder. Both the mixing tank and the feeder are fitted with hoods connected to a fan exhausting outside the plant.

All other reagents are stored in a building adjacent to the flotation section and are brought into the plant as required by a one-ton Telpher overhead crane which runs between the two buildings. A section in the plant is provided for the reagent mixing and storage vessels. The solutions are delivered by compressed air to the reagent feeder platform which is 33 feet above the flotation floor. All the feeders are constructed of steel and are of the disc and cup type, except for the copper sulphate feeders which are Clarkson stainless steel feeders.

Concentrates Handling

Each concentrate, copper or cobalt, is thickened in a 35-foot-diameter Dorr Type S Torq thickener. The thickener underflow is maintained at 65 to 70 percent solids by remote controlled hydraulically operated Sala valves and the thickened concentrates are pumped to distribution boxes located on a platform above the filter floor. The overflow from the thickeners flows to concrete settling ponds, where fine slime settles and the final overflow goes to waste.

There are three Dorr-Oliver 8- by 12-foot drum filters which are fitted with Crofts variable speed drives. One filter is used for copper concentrate, one for cobalt concentrate, and the third is available for either material. The filter cake falls onto belt conveyors which deliver the concentrates to their respective 200-ton-capacity concrete storage pens. Each pen is serviced by a Holman drag scraper which is used to load the concentrate into truck standing on a weighbridge.

The concentrates are trucked 10 miles to a railway siding and are then delivered to the treatment plants. The copper concentrate is treated at Mufulira Copper Mines Ltd. while the cobalt concentrate is smelted at Ndola to a cobaltiferous matte. This matte is shipped to Belgium for further treatment.

Tailings Classification

The tailing from the flotation sections is pumped to a tailings classification plant which operates continuously treating 100 tons of tailings and producing 55 tons of sand per hour. This sand contains a maximum of 10 percent minus-325-mesh material and is used for underground stope filling. Approximately half the tailings treated is Chibuluma tailing while the remainder is obtained from the nearby Nkana mine of Rhokana Corporation Ltd.

The Chibuluma tailing is pumped to a 10- by 10-foot agitator in this plant where it is mixed with the Nkana tailing, the latter being brought to the plant by truck and delivered to the agitator by belt conveyor. From the agitator, the pulp flows at 25 percent solids to a 30-foot-diameter Dorr hydroseparator where the first classification takes place, the overflow carrying about 30 tons of slime per hour. The hydroseparator underflow is controlled at 60 percent solids by two Dorr diaphragm pumps which deliver to a Hydroseal pump supplying twelve 12-in-diameter hydrocyclones. Water is added to the sump of this pump to give a hydrocyclone feed containing 25 percent solids. The cyclone underflow is diluted from 65 to 50 percent solids and is pumped to the mine. The dilution of this pulp is controlled by a Rotameter continuous density meter operating in conjunction with a Foxboro pneumatic recording-receiver-controller which operates the pneumatic Saunders valve supplying the diluting water.

The overflow from both the hydroseparator and the cyclones is pumped to a 100-foot Dorr Type S Torq thickener, from which the overflow is returned to the tailings classification plant, while the underflow, at 50 percent solids, is pumped to the tailings dam. This tailings pump is driven through a Vulcan-Sinclair fluid coupling to enable the pump speed to be adjusted to suit the pumping conditions.

General

All buildings are steel framed structures with walls and roofing of galvanized corrugated steel sheeting.

The pipes and vessels containing air, water, oil, flotation reagents, ore pulp, copper concentrate, cobalt concentrate, and tailing are painted in different distinctive colors. This considerably assists in identification and also improves the appearance of the plant.

Recording instruments, automatic controllers, and alarm systems are used extensively and contribute greatly toward the efficiency of the different operations.

Power is supplied to the mine from a Copperbelt grid system and is distributed to the concentrator sub-station as a 50-cycle, three-phase, 3,300-volt supply. The concentrator power consumption amounts to 17.1 kilowatt hours per ton of ore treated.

The normal operating crew consists of one shift boss, four European operators, and 34 Africans per shift. The administration, metallurgical, and assay laboratory staffs bring the total complement of employees in the concentrator to 29 Europeans and 115 Africans.

Acknowledgment

The writer wishes to record his appreciation to the management and directors of Chibuluma Mines Ltd. for permission to publish this article.

Iran's Minerals Attract New Interest

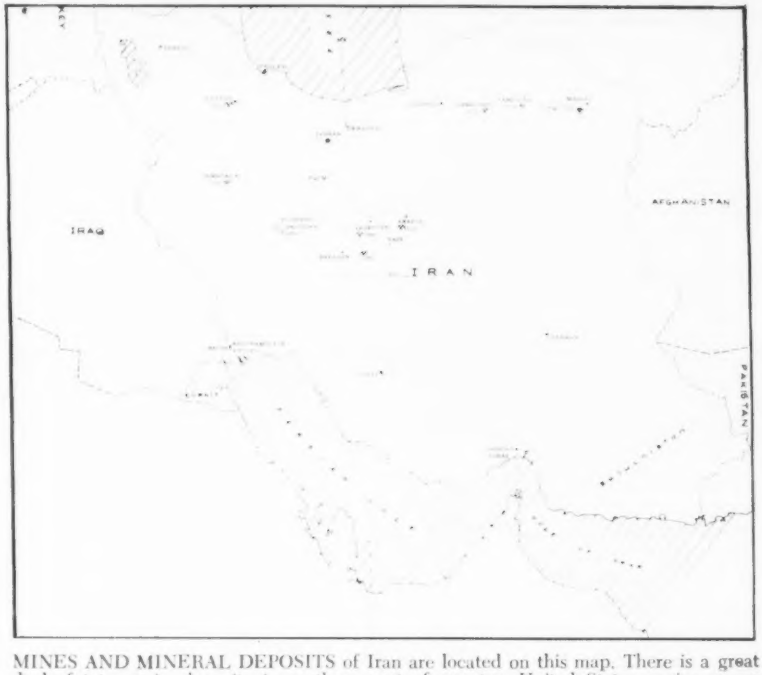
Oil-rich Iran, adjoining revolutionary torn Iraq and south of Russia, has a surprising number of undeveloped and even unprospected metalliferrous deposits—surprising, because her history of civilization dates before the birth of Christ.

For years, her economy has depended upon oil revenues, but the 1951-1952 dispute, which lead to the nationalization of the Anglo-Iranian Oil Company, made the government and the people realize the extent to which they were dependent on this single industry which still, with United States aid, brings the budgetary deficit within manageable proportions.

Now, without conceding one iota of her nationalistic aspirations, she is doing everything possible to encourage foreign investment for the development of the country. Already the Union Carbide Corporation of New York has a large concession for chromite.

The currency is strong and there is no foreign exchange problem: Mining companies are exempt from the payment of income tax for a period of five years from the beginning of their exports; exchange or the transfer of profits and return of capital from profits is permitted.

The Iranians have noted the unfavorable repercussions on foreign investment from former Premier Mohammed Mossadeq's high-handed nationalization policy, which they would now like forgotten. Nor is there any danger of a repeat performance from the present government which shows the maturity of outlook on international matters which might be expected from a nation which has survived so many viscissitudes.



MINES AND MINERAL DEPOSITS of Iran are located on this map. There is a great deal of interest in chromite in southern part of country. United States engineers are actively surveying Iran's minerals.

Plans For Geologic Survey

The desirability of topographical and geological plans for expediting development is no doubt realized by the government and the formation of a Geological Department is now under consideration.

The development of the many mineral deposits which are spread throughout this vast country has been hampered by difficult communications, lack of personnel trained in the technicalities of modern prospecting, and shortage of finance. The most primitive methods are used at many of the so-called producing mines and their operation is only possible because of very low labor costs.

However, the government is anxious to foster the industry. The Seven Year Plan Organization, through its Mining and Smelting Company, either on its own or in partnership with private firms, is responsible for a large proportion of Iran's mineral production.

The Mining & Smelting Company controls the small copper refinery which produces electrolytic copper at Aminabad. Copper ore is mined at Abbasabad, Anarek, Esfandogheh, and Zenzan; the total annual production is estimated at 11,500 tons.

Chromite is mined in the north-east between Shahrud and Sabzewar. There are chromite deposits in Baluchistan in the southern part of the country, and it is here that Union Carbide Corporation shares an interest with the Iranian Government over very large areas. Estimated chromite production for 1957 was 5,000 tons.

Lead and zinc are widely distributed. The main ore bodies are in the Khomein-Golpayegan area 165 miles southwest of Teheran. In the past, high-grade sections have been worked and the minerals recovered by hand sorting or other simple concentrating processes. The potential value of the deposits is realized by the government which, with Iranian, French, and German firms, is undertaking development using up-to-date methods. At least two flotation plants are being constructed and plans are in hand for the treatment of zinc oxide ore also.

Lead Zinc To Russia

Until now, the grade of concentrates produced has been very low. With no smelting facilities in Iran, producers have been forced to sell to purchasing agents from the U.S.S.R. who have an organization for sampling and assaying concentrates at the Caspian Sea port of Pahlavi. Prices are high, by Western standards, and payment is prompt in Iranian currency, or in machinery. In this way Russia is establishing some influence in the mining industry. It is estimated that about 30,000 tons of lead concentrates are sold annually to the U.S.S.R.

Turquoise for which Iran has long been famous is mined in the northeast close to the holy city of Mashed. Two or three hundred are employed in the industry which offers scope for expansion and development.

Many other minerals have been located in this ancient yet so far only superficially prospected country. But her political and geographical position between the East and West, between the Persian Gulf and the Caspian Sea, together with the encouragement given by the government to foreign investors, must inevitably lead to the fuller development of her mineral resources which are indicated as being considerable.

SIMPLICITY of underground hydraulic mining is striking; water does everything but final concentration. The need for drilling, blasting, muckling, and tramming is eliminated. Pumping requirements are non-existent.

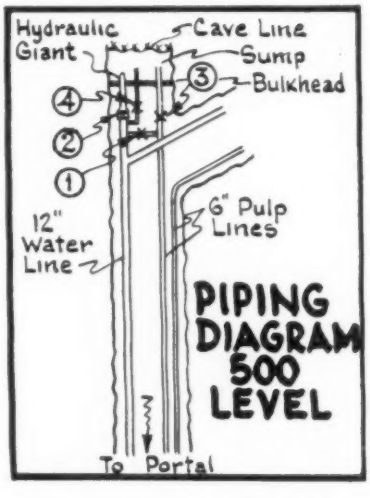
Underground Hydraulic Mining . . .

may solve stoping and sliming problems at Silver Butte

Water power is being harnessed for underground jet stoping, transport of broken ore to the mill, and preliminary 3 to 1 concentration of lead-zinc-silver ore at the Brooklyn mine, eight miles southeast of Maxville, Moutana. Now under the control of Silver Butte Mines, Ltd., the property underwent commercial-scale production tests during the summer months of 1957. Results looked so promising that plans were made for regular production and renovation of a 200 ton-per-day flotation mill.

Under this seemingly fantastic, but imaginative plan, a hydraulic giant is used to undercut and induce caving of a vertical, wide, soft and friable vein. The jet from the 1 9/16-inch nozzle on the moniter is directed normal to the strike of the ore from a station in the footwall of the lowest mine level. The ore breaks into slime, sand and chunks no larger than a man's fist, and is washed to a small sump adjacent to the moniter. It is then piped a total distance of 4,340 feet by suction and gravity to the mill where it enters a 40-foot diameter settling pond equipped with an adjustable overflow weir. The pipe profile traverses 1,340 feet of minus 1 percent grade to the portal of the mine adit. From the portal the line drops approximately 180 feet in 3,000 horizontal feet to the mill settling pond.

It is claimed that continuous decantation of the water at the settling pond up-grades $10 to $12 rock to a $30 to $40 washed product. In addition, troublesome slimes are rejected leaving clean ore for concentration by flotation.



Sequence For Start-Up Or Line Flushing

A. Open valve No. 1; valves No. 2 and 3 should be closed.
B. Fill the discharge line; this requires about 5 minutes; pressure drop to 0 psi when valve No. 1 is first opened then builds up to about 20 psi.
C. Open valve No. 2 and fill the sump.
D. Close valve No. 1 and open valve No. 3.

Water pressure at portal .... 70 psi
Water pressure at face .... 60 psi
Vacuum on discharge at portal 16 psi

During the test runs, 2 men and one giant were able to deliver 9 tons per hour of solids to the settling pond from which 3 to 3.5 tons of up-graded ore was obtained.

Old timers in the district say that previous attempts to work the property by conventional methods had always been hampered by two primary problems. The vein material was extremely weak though the wall rock was very strong. Secondly, where underground stoping had been used successfully to extract ore, milling was complicated by excessive sliming.

The mineralized structure strikes approximately north 20° west and dips steeply at about 70° to the northeast. The orebody, according to old engineering reports, was made up of a gangue or filling of soft grayish-white porphyritic material, through which streaks and bunches of sphalerite and galena occurred. The vein was contained in a country rock of strong, competent limestone which stands open over long spans with little or no support. The ore was apparently well fractured and yielded fairly large volumes of water. The clay-like material which hosted the ore showed a tendency to swell when wet. This clay or gouge is thought to compose about 70 percent of the mineralized structure. When the ground was disturbed by mining it became very heavy. Extraordinary amounts of timber were required to hold the stopes. The net effect of the above problems usually doomed most efforts at mining and

concentration to failure whenever metal prices slipped from high levels.

The mine had been developed to a depth of about 550 feet below the surface outcrop. Entry for past production efforts was gained through a series of 4 footwall adits driven at various levels and approximately at right angles to the ore. The lowest, or the 500 level, was the last to be driven and was in reasonably good shape when the mine was investigated for possible production early in 1957. Most of the old workings in ore, however, were then caved and inaccessible.

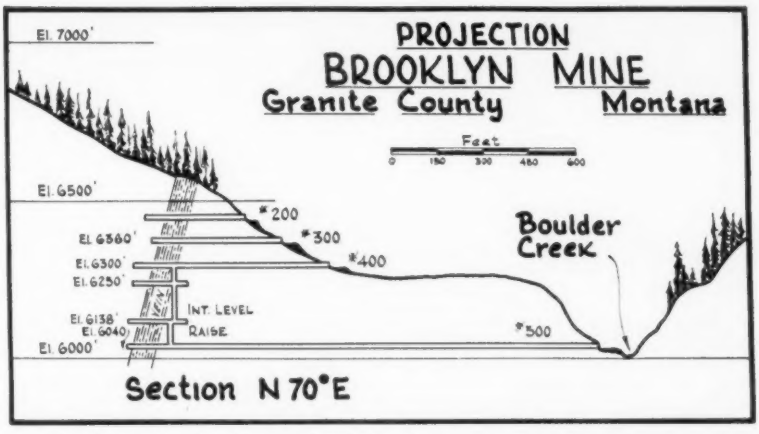
Since nearly every conceivable type of stoping method had been tried at the Brooklyn mine with only indifferent success, a radical scheme of low-cost extraction was required for this day of low metal prices. Someone idly suggested the use of a hydraulic moniter to Earl Ellis of Treasure State Uranium Corporation. Treasure State Uranium was in control of the property in 1957. Ample water for a hydraulicking operation was available. Boulder Creek flows within 100 feet of the portal of the 500 level.

Mr. Ellis tested the idea, claims that it works just fine and points to a settling pond now containing approximately 400 tons of dry, milling-grade solids. This product, obtained from a 2-week production run in 1957, was said to assay approximately $35 per ton in silver, lead and zinc. Treasure State Uranium subsequently assigned control of the property to Silver Butte Mines for a stock interest in the operation.

The operators went up-stream for about 0.8 of a mile to tap the water for the hydraulic operation. The water is brought to a bench directly above the portal of the mine by ditch, flume and 14-inch pipe. Flow from the intake at the creek to the bench above the mine is entirely by gravity.

From a position above the 500 level the water drops almost 200 feet through a 14-inch penstock to the entry. It is taken into the mine through 12-inch pipeline where a connection is made to the moniter at the working face. Incidentally this adit is just as straight as an arrow, and from the face the portal is visible over 1,300 feet away.

The moniter is located just far enough back of the footwall contact to provide splash room and sufficient clearance for construction of a small sump between the moniter and caving vein. The sump is made by simply blocking 2 or 3 layers of 2- by 6-inch lagging to opposite walls of the crosscut at the sill. It is covered with a grizzly containing 4-inch square openings and is drained by a 6-inch pipeline which enters the sump at the sill.



MINE had been developed to 550 feet below the outcrop in past years by a series of 4 footwall adits. Most upper workings are caved, but 500 level has been rehabilitated for production; all moniter stations will go on the lowest level.

A valved connection is made between the 12-inch water line and 6-inch pulp pipeline just behind the moniter (see diagram). This was installed to provide a positive means of filling the 4,300 feet of 6-inch pipe with clear water all the way to the mill and thereby creating the required suction when hydraulicking starts. A valved auxiliary pipe is led from a point just behind the moniter to the sump. This was provided so that water can be bled to the sump during occasional periods when it may be necessary to stop the moniter temporarily. At this time lumps accumulating on the grizzly can be broken. Such bleeding keeps the sump filled during these periods preventing loss of suction in the discharge line and possible plugging of the pipe with pulp. During operation the discharge line is flushed every 2 hours.

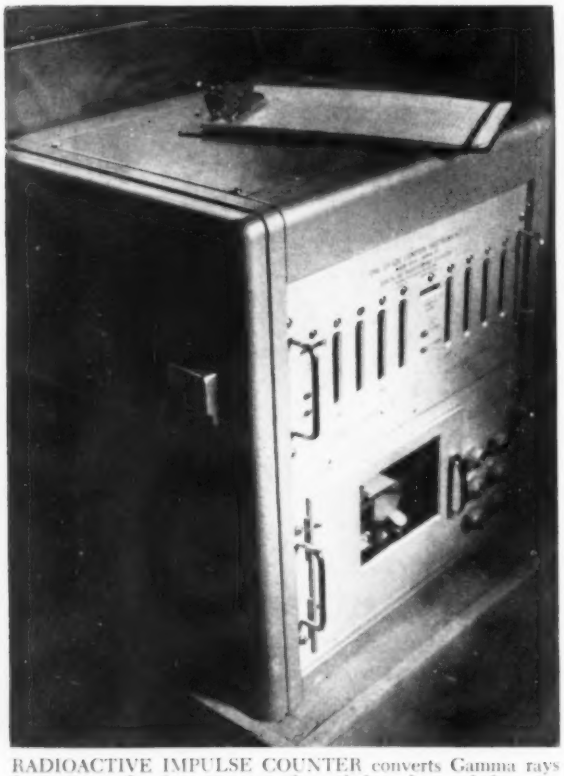
Estimated Direct Cost Looks Attractive

Selective mining, if it were possible, would probably yield ore valued at $20 to $30 per ton if valued at today's metal prices. Reports of old channel samples taken across 40-foot faces on the 500 level returned assays averaging about 7 percent zinc, 2.5 percent lead and 8 ounces of silver per ton. Geologic information indicates that ore was found in high-grade bands and bunches, but hydraulicking will result in dilution. Even so, recovery of $10 to $12 ore looks reasonable. Reserves are estimated at close to 400,000 tons.

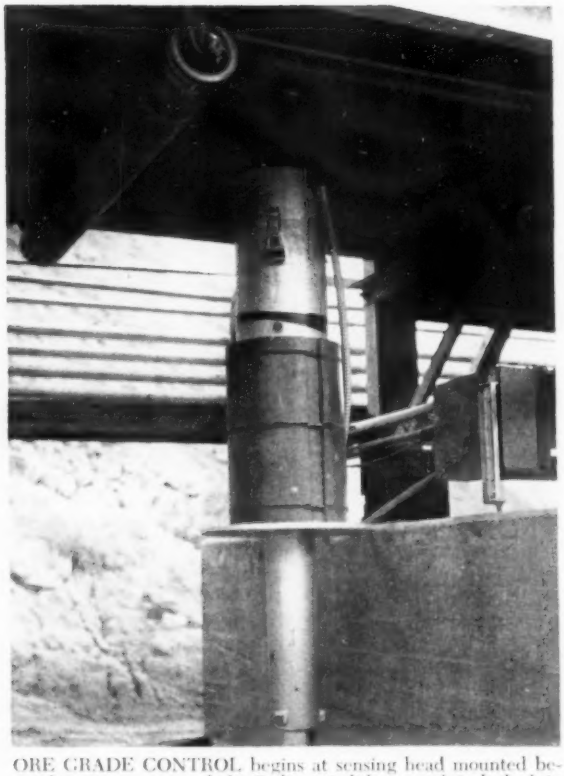
The direct cost of jet stoping and 3 to 1 concentration will be somewhere between $0.40 and $1.22 per ton of ore washed from the mine. This will vary according to the number of mine shifts that are worked and number of hydraulic moniter shifts.

Based on results obtained last summer (9 tons of $12 ore per 1 9/16-inch moniter shift), the costs outlined in the table below might be expected. Other charges would include maintenance necessary for flume, ditches and pipelines. Also the labor and machine cost for construction of settling ponds should be added to the tabulated costs. Approximately $12,000 has been spent on piping to date and this should be amortized over the life of the operation.

No. of Mine Shifts	No. of Moniter Shifts	No. of Man-Shifts @ $18 per shift	Supervisor Salary Per Operating Day	Total Direct Labor Cost	Total Output of $12 Ore @ (9 tph per moniter shift & 6 hrs. on time)	Labor cost per ton ($12 ore)	Total Recovery $35 ore by Settling	Labor Cost Per Ton of Upgraded $35 ore
1	1	2×18=$36*	$30	$66	54	$1.22	18	$3.67
2	2	4×18= 72*	30	102	108	$0.94	36	2.83
3	3	6×18=108*	30	148	162	$0.91	54	2.74
1	2	2×18= 36	30	66	108	$0.61	36	1.83
2	4	4×18= 72	30	102	216	$0.47	72	1.42
3	6	6×18=108	30	148	324	$0.46	108	1.37
1	3	3×18= 54	30	84	162	$0.53	54	1.56
2	6	6×18=108	30	148	324	$0.46	108	1.37
3	9	9×18=162	30	192	486	$0.39	162	1.19



RADIOACTIVE IMPULSE COUNTER converts Gamma rays from sensing head into measured, totaled, and recorded counts which are converted to net counts for determining percent U_3O_8.



ORE GRADE CONTROL begins at sensing head mounted beneath main conveyor belt. Sodium iodide crystal is locked in lead shielding so that input ray angle takes full belt width.

How Anaconda Automatically Assays Jackpile U_3O_8 Ore For Grade Control

Automatic radiometric assaying of Jackpile uranium ore as it is loaded into railroad gondolas has been successfully done by the Anaconda Company for the past year.

Anaconda's Jackpile mine on New Mexico's Laguna Indian Reservation is the world's largest uranium pit where approximately 3,000 tons of ore are mined daily, crushed to minus-4-inches, and loaded by conveyor belt into 80-ton gondolas for shipment over the Atchison Topeka and Santa Fe railroad to the mill 40 miles away at Bluewater.

While the ore body is large, it is very variable in grade even within a few feet. Each blast opens a new face of different grade than the preceding one and this grade change is compounded by equally marked and sudden changes in uranium content in the vertical dimension.

It is important to maintain a uniform grade of shipments to the mill so that maximum effective uranium loading can be achieved in the Resin-in-Pulp circuit. Because uniform grade day-by-day is an ideal situation which is not attainable, it is most important for the mill to know the grade of ore, by cars, from the mine so that the values can at least be distributed uniformly to each of the three milling circuits. Mill blending is complicated by only four dumping pockets.

Thus Anaconda, with a critical need for grade control at the mill and an ore body with almost foot-by-foot grade changes, sought a method to determine cheaply, speedily, and accurately what was the uranium content of each car loaded.

To do this, the Eberline Instrument Corporation of Santa Fe, New Mexico, working in close collaboration with Anaconda engineers, have perfected the Ore Grade Control Instrument. This is a radiometric impulse counter which gives a very close approximation of ore grade by measuring and counting the Gamma rays emitting from a bed or ore on a conveyor belt passing over the sensing heap.

The entire unit consists of the sensing heap containing a sodium iodide crystal mounted beneath the crushed ore loading conveyor belt, a source of alternating current, and a special radiometric impulse counter.

SENSING HEAD is mounted in a special round cylinder with the bottom and the lower one half shielded by lead. This prevents stray gamma rays from influencing the crystal. This unit is solidly mounted below the conveyor belt as shown in the illustration. Crystal is set so input ray angle takes full belt width. Of course, if the position of the unit were to be changed, in relation to the belt, a new series of grade correlation factors would have to be worked out. It is necessary to keep the area around the unit clean and any ore spillage from the belt must be re-

moved immediately. Ideally the belt should be uniformly loaded at all times.

ELECTRICITY is supplied by an independent generator set with a large flywheel. It is absolutely necessary to maintain uniform voltage and cycle within the radiometric circuit. While the 110-volt electric motor may change speed with peak power loads the flywheel on the generator helps to prevent fluctuations in input to counter circuit.

RADIOMETRIC COUNTER is mounted in the car loader's office. It is built inside a steel cabinet about 30 inches square. A series of gauges total the number of radioactive counts received from the sensing head about 70 feet away. In addition to totaling the count, a permanent record of any count is printed on a roll of paper tape whenever the operator pushes a button—start and stop of car loading, for example.

The operator controls truck dumping, crusher operation, and loading conveyor operation. He also has the important job of obtaining a background count every two hours, reading and recording the data from control instrument, and regulating tonnage loaded into each car.

First, a description of normal crushing and loading operations: The 23-ton Euclid trucks from the mine dump directly onto a pan feeder discharging to a 4-inch sloping bar grizzly ahead of a 42- by 48-inch Pioneer jaw crusher. Grizzly and crusher undersize drop to a 48-inch conveyor belt 425 feet long extending to the car loading station alongside the railroad spur. Ore is weighed by Weightometer on the belt with weight recorded in the office.

When the operator comes on shift he checks the cars spotted during the night and records the net load weight of each car in the order in which it will be loaded.

Loading starts as trucks dump; ore is crushed and conveyed to cars (which are dropped by loading crew to obtain uniform distribution), and weight cumulated on dial in office. The operator stops the feeder which then stops the main belt when a car has been loaded to maximum net allowable weight. He then signals for loading crew to drop an empty into loading position and the process is repeated. There is flucuation, of course, in loading time with the arrival of ore trucks from the pit.

Here's how the radiometric counter is operated as loading proceeds:

BACKGROUND COUNT FIRST. It is necessary to first determine the background count. The operator turns on machine and lets the clean belt run empty for a uniform time (10 minutes). He then reads and records the number of counts on the machine; this is also printed on the tape recording unit built into the counter. The time of day, temperature, time in minutes, and counts per minute are all logged. This gives background count per minute and it is repeated every two hours to get new correction figure.

LOAD THE CAR. A car is now loaded with the machine turned on. The time necessary to load the car and the number of counts made by the machine are recorded; also the cumulative loading time is recorded.

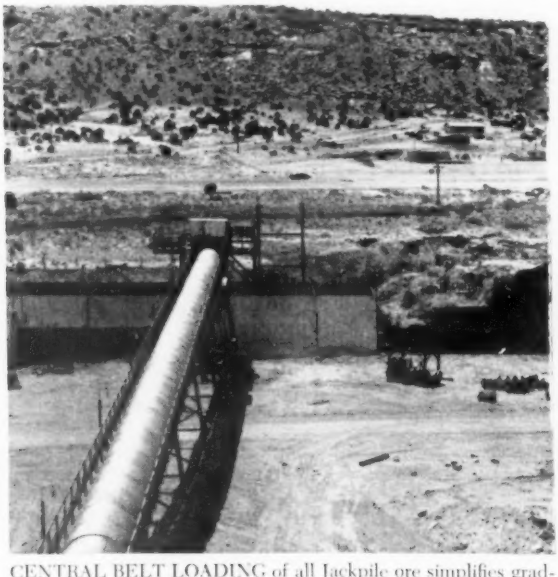
COUNTS PER CAR. The higher the ore grade the more counts the machine will register. The operator reads the number of counts recorded on the machine before car is loaded and after loading is complete. The numerical difference is the gross count per car. Gross count per car is converted to net count by deduction background count per minute multiplied by the number of loading minutes. The operator logs the gross count (ore plus background) and the net count (gross count less cumulated background).

This is the report that the loading operator turns in to the production engineer at the Jackpile. The engineer then uses an established factor to convert the net count grade to estimated grade in percent U_3O_8. Accuracy within 0.02 percent of actual grade

Anaconda's Jackpile Uranium Mine Railroad Car Loading Report For Three Consecutive Cars

Labeled Car (Weight)	*Car Number*	*Daily No.*	*Weightometer Read*	*Weightometer Net*	*Loading Time Read*	*Loading Time Net*	*Counts Per Car Gross*	*Counts Per Car Net*	*Estimated Grade*
160,000 (pounds)	AT 4031	1	80 (Tons)	80	9.8	9.8	168	101	*
160,000	AT 7664	2	159	79	19.5	9.7	160	85	*
160,000	AT 7601	3	340	81	27.8	8.3	126	70	*

*Not known by operator. Left blank to be filled in by production engineer.



CENTRAL BELT LOADING of all Jackpile ore simplifies grading. All ore passes directly from extending crusher to railroad cars over sensing head mounted beneath conveyor belt.

SAMPLE TOWER on floor of pit is used to speed Gieger and grab sampling of each truck load of material mined near ore zone. Sampler at work on top of load.

POUR PRIMER THEN AMMONIUM NITRATE into blast holes. Man at left is loading free running primer in hole.

SOAK AMMONIUM NITRATE with Diesel fuel right in the bag before loading into holes. Note how 8.0 percent addition of oil to each bag has soaked completely through nitrate as shown by wet and colored bag bottoms.

is routine. This factor is established periodically by actually sampling and chemically assaying ore loaded over a set period. This factor is established for an entire month's production and remains constant until the crystal in the sensing head is changed. A new factor then must be established.

The number, ore tonnage, and estimated grade for each car is radioed to the mill in the afternoon so that car dumping and mill operation can be planned for the next day, when cars are unloaded.

The instrument has proved very accurate and, in addition to the improvements in mill operation, has enabled the mine staff to mine much closer to a pre-set grade. The supervisors, by checking loading operations several times a shift, can easily determine if abnormally high or low grade ore is being shipped. If so, shovels are changed to different faces or one or more trucks rerouted to another shovel for blending.

Careful checking of grade is maintained at all times in the pit, too. Anaconda is using a sample tower (see photograph) to quickly Geiger every truck load of material taken from the ore horizon. This is particularly important in stripping the last few feet of waste to the top of the ore. It may not look like ore and the exploration drilling logs didn't indicate ore but the Geiger counter shows it to be ore grade so it is hauled and dumped in an ore stockpile on the pit floor. The sampler grabs a sample from ore truck which is assayed to confirm stockpile grade. The very next truck load may be just below ore grade so the sampler directs it to one of the low-grade stockpiles outside the pit area proper. The next truck, if waste, is then sent to one of the main stripping dumps.

BLAST HOLE DRILLING and blasting have been improved during the last year by using a new Joy BH 59 blast hole drill and a Winter Weiss 6TA Portadrill in waste and prilled ammonium nitrate as a blasting agent.

The Joy waste holes, 7⅞-inch diameter are spaced 22 feet apart and drilled 45 feet deep with an average drill-shift footage of 700. The 6¾-inch Portadrill holes are spaced from 16 to 22 feet apart and drilled at an average of 500 feet per shift. Tri-cone bit life on both drills is between 1,800 and 1,900 feet before retipping to give an additional 50 percent of initial footage.

Ore-blast and sample holes are drilled to varying depths, 4¾-inches in diameter on a 6 to 10-foot spacing by a truck-mounted Failing unit. When bit gauge has been reduced to 4¼-inches, after drilling an average of 1,500 feet, the bit is discarded.

Anaconda has steadily advanced the art of ammonium nitrate blasting. First, in the Yerington pit at Weed Heights, Nevada, and then in the Berkley pit at Butte, Montana. Now, the Jackpile has made other improvements which include soaking the nitrate prills with Diesel oil from 24 to 72 hours which yields greater energy upon detonation, and the use of free running 40 percent primer powder to speed hole loading.

To the top of each paper-polyethylene bag of nitrate 8.0 percent (by weight) of Diesel oil is added. The bag is allowed to sit in the open for more than 24 hours so that the Diesel oil has an opportunity to completely percolate to the bottom and be absorbed by the ammonium nitrate. It is then trucked into the pit to the round to be blasted.

Whereas most ammonium nitrate is set off with a solid nitroglycerin type primer (45 and 60 percent dynamite), the Jackpile now uses a 40 percent free running Dupont Hi Cap powder as a primer. Primacord leads are used to detonate this primer. As many as 100 ore holes are shot in one blast, but seldom over 30 waste. Special care is exercised in loading the waste holes because of the variations in the rock stratum within one hole. Deck loads are concentrated in the harder rock sections. To minimize back-break, all waste holes are loaded from 20 to 15 feet from the collar. Ore holes are loaded within six feet of the collar.

One advantage of these powders is fast loading.

TO LOAD: primacord lead is dropped to the full depth of hole and one man then pours primer into bottom of hole directly from sack. A second man immediately pours Diesel-soaked ammonium nitrate into hole until it is filled 10 feet above primer, then he stops and first man pours in more primer, on top of which ammonium nitrate is again loaded. Primer is figured as eight percent, by weight, of the powder load and about four pounds comprises each layer. In all holes, no more than 10 feet of ammonium nitrate ever separates the primer layers.

Despite the greater poundage of primer used by this method, the Jackpile staff feels that it is cheaper in the long run because of ease and quickness of loading.

With more than 1,000,000 tons of waste and ore drilled, shot, loaded, and hauled from the Jackpile each month, superintendent John Herndon and his staff of Floyd Ballantine, assistant superintendent, and foreman, B. F. Barlow, are continuously seeking new methods and equipment to move more muck faster and cheaper. THE END.

U.S.A. Metal & Mineral Prices

METALS

September 23, 1958

COPPER: **Electrolytic.** Delivered F.o.b. cars, Valley basis (Pound) 26.50¢
Lake. Delivered, destinations, USA 26.50¢
Foreign Copper, Valley basis 26.50¢
Custom 26.50¢
LEAD: **Common Grade.** New York (Per pound) 11.00¢
Tri-State Concentrate, 80% lead, per short ton $127.32
ZINC: **Prime Western:** F.o.b. E. St. Louis (Per pound) 10.00¢
Prime Western: Delivered, New York 10.50¢
Tri-State Concentrate, 60% zinc, per ton $56.00
ALUMINUM: **Primary 30 Pound Ingots (99% plus)** (Per pound) 26.80¢
ANTIMONY: **Lone Star Brand. F.o.b. Laredo, in bulk** (Per pound) 29.50¢
BISMUTH: (In ton lots) price per pound $2.25
CADMIUM: **Sticks and bars.** 1 to 5 ton lots (Price per pound) $1.55
COBALT: **97.99%,** keg of 550 pounds (Price per pound) $2.00
COLUMBIUM: **Powder** Nom., per pound $55.00-$85.00
GERMANIUM: **Germanium:** dioxide, high purity, gram 18.50¢
LITHIUM: **98%** (per pound) $11.00-$14.00
MAGNESIUM: **Ingots (98.8%)** F.o.b. Valasco, Texas, per pound 36.00¢
MERCURY: **Flasks.** Small lots, New York
NICKEL: **"F" Ingots (5 pounds).** F.o.b. Port Colbourne, Ontario 75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay $30.00 to $40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram $30.00
SELENIUM: **99.5%,** per pound $7.50
THORIUM: per kilogram $43.00
TIN: **Grade A Brands.** New York (Per pound) Prompt delivery. 86.50¢
TITANIUM: **99.3%** + Grade "A" Sponge (Per pound) $1.65-$2.05
URANIUM: **Nominal,** per kilogram $40.00
U-235: **Nominal** (Per pound) $7,725
GOLD: **United States Treasury Price** $35.00 per ounce
SILVER: **Newly mined domestic.** U.S. Treasury price per ounce 90.5¢
Foreign Handy Harmon 88⅝¢
PLATINUM: Per Ounce $62.00-$65.00
ZIRCONIUM: **Sponge,** Per pound, Reactor Grade $5.00

ORES AND CONCENTRATES

BERYLLIUM ORE: **10 to 12% BeO.** F.o.b. mine, Colorado $46.00 per unit Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $48.00.
CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons
African (Rhodesian). 48% Cr_2O_3. 3 to 1 Ratio $45.00-$47.00
African (Transvaal). 48% Cr_2O_3. No ratio $31.00-$33.00
Turkish, 48% Cr_2O_3. 3 to 1 chrome-iron ratio Nominal $52.00
U.S. Government ore purchase depot Grants Pass, Oregon, Base price, lumpy ore, $115.00; fines and concentrates $110.00 for 48% Cr_2O_3 and a 3 to 1 chromium-iron ratio. Premiums for higher grade are and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr_2O_3. Buying suspended, quota filled.
COLUMBIUM-TANTALUM ORE: At United States small lot beryl purchase depots. $3.40 per pound contained combined pentoxides in 50% ore. Includes 100% bonus. (Government stopped buying temporarily May 12, 1957) Per Pound Pentoxide $1.15
IRON ORE: **Lake Superior. Per gross ton Lower Lake Ports**
Mesabi, Non Bessemer, 51.5% Fe $11.45
Mesabi, Bessemer, 51.5% Fe $11.60
Old Range Non Bessemer $11.70
Old Range Bessemer $11.85
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit 26.00¢
MANGANESE ORE: **Metallurgical grade.** 48 to 50% Mn. Long ton unit $1.05-$1.10
Metallurgical grade. 46 to 48% Mn. Long ton unit $1.00-$1.05
Metallurgical grade. 44 to 46% Mn. Long ton unit $0.95-$1.00
Domestic U.S. Government purchasing depots: Butte, Mont.; (black and pink ores) base price of $4.87 per long dry ton of 18% manganese ore, Phillipsburg, Mont.; base $6.43 per long ton of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40%. Base (48%) $2.30 per unit with premiums and penalties.
MOLYBDENITE CONCENTRATE: **90% MoS_2 F.o.b.** Climax, Colorado. Per pound Mo, plus container cost $1.18
TUNGSTEN CONCENTRATE: **Domestic.** 60% WO_3 Per short ton unit $12.00
Foreign. 65% WO. Per short ton unit (Scheelite) Nominal $9.00
Foreign: South American, Spanish, Portuguese Nominal $8.00
URANIUM ORE: F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is $1.50 per pound of U_3O_8 in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.

NON-METALLIC MINERALS

BENTONITE: **Minus-200-mesh.** F.o.b. Wyoming. Per ton, carload lots $12.50
Oil Well grade. Packed in 100 pound paper bags $14.00
BORON: Technical grade F.o.b. Boron, California. Per ton $47.50
FLUORSPAR: **Metallurgical grade.** 72.5 % effective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines $36.00-$40.00
Mexican. 70% F.o.b. border $26.00-$27.00
Acid Grade. 97% CaF_2, Bulk, F.o.b. mine $48.00-$52.00
Government buying F.o.b. producer's shipping point: 60% Illinois-Kentucky, $34.50 per ton, others $28.50; 70% Ill.-Ken. $38.50, others $32.50.
PERLITE: **Crude:** F.o.b. mine per short ton $3.00 to $5.00
Plaster grades. Crushed and sized. F.o.b. plants $7.00 to $9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas $25.00
Export $24.00-$25.00

LONDON METAL AND MINERAL PRICES

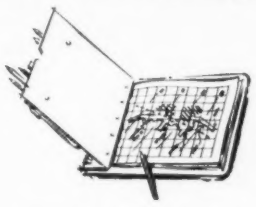
September 23, 1958

		Per Long Ton	USA Equivalent cents per pound[1]	
COPPER:	**Electrolytic spot**	£212	10s 0d	26.56¢
LEAD:	**Refined 99%**	£ 70	5s 0d	8.78¢
ZINC:	**Virgin, 98%**	£ 65	0s 0d	8.12¢
ALUMINUM:	**Ingot, 95.5%**	£180	0s 0d	22.50¢
ANTIMONY:	**Regulus, 99.6%**	£197	10s 0d	22.69¢
TIN:	**Standard, 99.75%**	£640	0s 0d	80.00¢
TUNGSTEN:	**Long ton unit**	62s		$8.68

1. With Sterling pound at $2.80

Quotations on metals and certain ores through the courtesy of *American Metal Market, New York, N. Y.*

From a Geologist's Notebook



Where To Prospect For Western Taconite

There has been a growing, yet almost unnoticed, interest in western iron ore deposits. In fact, large scale claim staking which has been underway by United States Steel Corporation in the Iron Mountain District, Sweet Grass County, Montana, for over a year has been under wraps so to say. On October 3, 1957 United States Steel filed notices for about 100 claims at the county seat at Big Timber.

Why this interest? Well it's obvious when you consider the soaring steel use in the west as population and industry grows. With no blast furnaces on Pacific tidewater in the United States, low-cost foreign ores are not low cost when railed to inland furnaces.

With rather limited reserves of high-grade direct furnacing ore in California, Utah, and Wyoming, the geologists have followed the pattern set on the Mesabi and have turned to low-grade, Pre-Cambrian age, magnetic iron formations not unlike the Lake Superior magnetic taconites.

When United States Steel Corporation (Columbia-Geneva Division) stepped in and optioned the Ruby Corporation's extensive taconite deposits at Atlantic City, Wyoming in 1956, an immediate reinvestigation of other similar deposits was started. Ruby Corporation is a subsidiary of J. R. Simplot Company, Boise, Idaho.

Minerals Engineering Company of Grand Junction, Colorado secured control of the iron prospects on Carter Creek in the Ruby Range southeast of Dillon, Montana and started diamond drilling in 1956.

The third similar geologic area now in the news with extensive claim staking reported is south of Big Timber, Montana in the Bear Tooth Absaroka Mountains.

What about these deposits from the view point of prospector and geologist? First, the rock is heavy. Second, it is magnetic and will attract dip needles compasses etc. Third, the deposits have a distinctly banded structure.

Outcrops are weathered to a typical reddish brown or reddish rust color. Depth of oxidation is very shallow except along faults and fissures. Hard, dense, black or silvery black rock can be found by breaking the rock within a few feet of the surface in many places.

Mineralogically, the rock is primarily magnetite and silica (quartz). There is some hematite. The iron formation also concontains iron silicates, such as hypersthene.

Now for some specific characteristics: Specimens from the Atlantic City deposit outcrop show almost a platey structure. The Carter Creek ore bodies show typical Pre-Cambrian folding and some drag faulting along the folds. They are all found in areas of typical Pre-Cambrian rock: mica schists, granitic gneiss, and quartzite.

The areas of economic interest are large. They have a strike length several tens of times their width; in fact so large that the formation might appear to the untrained prospector as country rock. It was less than 10 years ago that the Carter Creek deposit was recognized as of possible economic interest. In the true meaning it had been discovered scores of times before by many prospectors. The Carter Creek outcrop is 250 to 1,200 feet wide, and 10,000 to 12,000 feet long. Atlantic City deposit is of similar size.

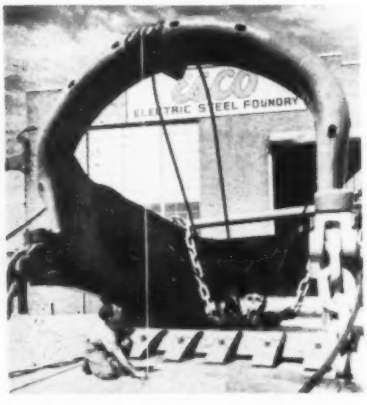
Metallurgical testing has shown that high-grade, 60 percent plus, iron concentrates can be made recovered by magnetic separation following grinding. Carter Creek ore liberates at about a minus-150-mesh grind which is coarse compared to Mesabi taconites. A 60 percent plus concentrate can then be easily made by magnetic separation.

Geologic studies and airborne magnetic prospecting continues from the Canadian border to Cedar City, Utah, and east to the Black Hills for iron deposits. Many geologists believe, and probably correctly, too, that there are thousands of cubic miles of similar Pre-Cambrian formation to be prospected in this vast area. The formation is known to crop out in places along the Montana-Wyoming border but much of it has been enclosed by Pre-Cambrian granite. In western Sweetgrass County, Montana the formation has apparently been covered by overthrust Paleozoic sediments.

There's plenty of room to prospect and the targets are big. The big markets are not too many years away.

PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.



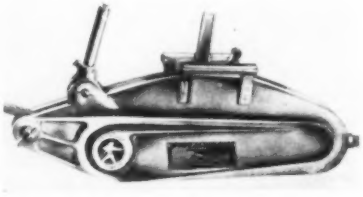
Esco's New Dragline Bucket Capacity is 35½ yards

A 69,000 pound tri-tapered dragline bucket, claimed by the Electric Steel Foundry Co. to be the largest in the world, has recently been completed. The bucket will be used on a Marion Super 7800. ESCO Alloy 12M and manganese steel castings along with US Steel's T-1 plate are the materials used in the bucket. The tri-tapered design makes it easier to dig large rocks, and increases yardage of each bite over other types of buckets. This bucket design won MINING WORLD's Blue Ribbon Award for 1958.

Average width of the bucket is eleven feet two inches, height from the ground to arch, thirteen feet five inches and the overall length is eighteen feet nine inches. Two and three-quarters inch wire rope will be used for hoist cable, and drag cable will be three and one-eighth inches in diameter. Loaded weight of the unit will be approximately 175,000 pounds. For more information write the company at 2141 N.W. 25th Ave., Portland 10, Oregon.

General Designs New Tire For Use in Rugged Terrain

General Tire & Rubber Company has announced a new tire for use on the front wheels of earth moving equipment. Designated the Rock Rib, the new tire is said to provide maximum steering ease and reduces side slipping to a minimum. The tire features General's Nygen cord, and has an ultra-heavy ribbed tread with a variable slope in the groove design which aids in ejection of stones and rock fragments. The thick tread and shoulders are said to consist of a specially compounded, cut resistant rubber stock. Tubed tire is available in sizes 10.00 x 20 through 14.00 x 25. Tubeless tire sizes are 12.00 x 25 and 14.00 x 25. The company will supply you with full details, at Akron, Ohio.



60 Pound Griphoist Unit Can Hoist 6,000 Pounds

Here is the new T-35 Griphoist, portable hoisting unit. Weighing only 60 pounds, the unit is conservatively rated to hoist 6,000 pounds. The T-35 is a companion product to the standard Griphoist unit which has a capacity of one and one-half tons and weighs about half as much. Alternately gripping, self-energizing jaws are featured, as well as a ball bearing crank, two-speed mechanism which allows cable travel from three to nine feet per minute, and a self-locking shackle type pin to permit quick anchoring of the unit. The T-35 has unlimited cable travel, requires a minimum of set-up time, and is lightweight and portable. Wire rope, having a diameter of ⅝-inches is used. For more information write: Griphoist, Inc., 424 Bryant St., San Francisco 7, California.

Improved Properties in New Build-Up Electrode

Build-up electrodes too often lack vital properties that are necessary to provide all characteristics essential in such a material—high tensile strength, resistance to cold flowing under compressive load, high impact strength, low tendency to work hardening and limited increase in hardness under severe quench. Only an exact balance of alloys will produce these qualities.

Stoody Company has just announced its new electrode for manual application called Stoody Build-Up (Iron Powder Coating) to fulfill the requirements above. Aside from those deposit properties, the new rod at 250 amps has a deposition rate of better than six pounds per hour. Operating either AC or DC (either polarity) weldability is excellent, efficiency is remarkably high and spatter loss is low. It may be applied in either stringer beads or wash passes; build-up is unusually high with good penetration of the base metal.

A 2-pass weaved deposit on medium carbon steel shows a Rockwell C hardness of 26; stringer beads on the same base metal give a reading of Rockwell C 33. Deposits are subject to heat treatment; water quenching from 1600° F increases hardness to Rockwell C 44. Stoody Build-Up (Iron Powder Coating) work hardens only two or three points. Descriptive literature is available from Stoody Co., at: 11928 W. Slauson Ave., Whittier, California.

Aerial Electromagnetic Surveys by Fairchild

Fairchild Aerial Surveys, Inc., 224 East 11th St., Los Angeles 15, California, has announced its exclusive licensing for the use of the American Metal Climax, Inc., helicopter electromagnetic surveying system. Through the helicopter EM unit, known as HEM, Fairchild now offers a new aerial geophysical service with direct application to mineral exploration. Thoroughly tested, the HEM is used to locate, from the air, zones of good electric conductivity at or near the earth's surface. Minerals, such as sulfides of copper and lead, which are good conductors can be directly located by the HEM.

An outstanding feature and advantage of the Fairchild HEM is its ability to give detailed information on small as well as large ore bodies. This unit is available for use in all countries in which helicopters can be leased or rented. Fairchild is in a position to perform EM surveys on short notice. For complete information on this system, and for results of test flights over known ore bodies, write to firm at address given above.

A LISTING of a tremendous stock of machinery and supplies recently taken out of service at the Black Rock Mine and Mill, Bishop, California, and the Lincoln Mine and Mill, Tempiute, Nevada. All equipment is listed in a new brochure published by Morse Bros. Machinery Co., 2900 Brighton Blvd., Denver 1, Colorado. Write for your copy.

CHEM-JET is the name of the new system developed by Johnson March for dust suppression in mines and other points where dust is a problem. In essence the system consists of jets placed in key areas where dust conditions are present. The jets emit a fine spray of Compound M-R, a wetting developed by Johnson March. This system entails a minimum of equipment for maximum dust suppression. Send for illustrative booklets. Write to Johnson March, 1724 Chestnut St., Philadelphia 3, Pennsylvania.

ATOMIZED FERROSILICON for heavy media separation is described in a bulletin available from Progressive Color & Chemical Co., Inc., U. S. Distributor for Knapsack-Griesheim AG. The bulletin describes the properties of atomized ferrosilicon, and explains why this spherical material helps you reduce costs and offers considerable operating ease. If you are using heavy media separation or have plans for future use, you will want a copy of this informative bulletin. Circle No. 3.

HOW TO GET BETTER WELDS is a new and completely revised edition of Weldors' Vest Pocket Guide containing 60 pages of useful arc welding information. This handy booklet is now available free of charge from Hobart Brothers Co., Troy, Ohio. Use reader service card and write to the company for your copy.

GOOD MACHINE PERFORMANCE is usually traced to proper operator care. As an aid to operators, a new D7, D8 and D9 Tractor Maintenance guide has been prepared by Caterpillar Tractor Co., Peoria, Illinois. The 24-page guide has more than 75 full color drawings of helpful hints for obtaining optimum service life from "Cat" equipment. Use reader service card and write to company.

HEAVY MEDIA SEPARATION: The Ore & Chemical Corp., 80 Broad St., New York 4, N.Y. have recently published a new brochure on their line of Heavy-Media equipment. Descriptions are given on units ranging in size from lab models to models with up to 400 tph of feed. Use reader service card to send for your copy. Write to company at above address.

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OCTOBER 1958 **NOT GOOD IF MAILED AFTER DECEMBER 25**

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HOUGH PAYLOADERS: Three new literature pieces covering Hough Payloader equipment now are available from International Harvester Export Company. Various attachments are also described including the Drott 4-in-1 bucket, available exclusively on Payloader tractor-shovels. For your copy write the company at 180 N. Michigan Ave., Chicago 1, Illinois, U.S.A.

FILTER AND DUST COLLECTOR: A booklet on a new type filter and dust collector is now available for you from Filterbau-Gesellschaft, m.b.H., Germany. This unit effectively cleans dustladen air or gas and the dust collected for return to production or for disposal. Circle No. 6 for your copy.

LW-30: This is the name of the new Letourneau-Westinghouse off-highway truck. The two-axle carrier, has a capacity of 30 tons without spillage, and has a loading height of only 108 inches. New design arrangements enable the truck to make a complete turn in 43 feet and power steering helps an operator steer with a minimum amount of effort. Unique air-hydraulic suspension effectively cushions the beating of off-the-road hauling. Send for new descriptive booklet. Write the company at Peoria, Illinois, U.S.A. Use reader service card for quick reply.

MINE VENTILATION: A new 24-page catalog describes the production, construction and application of ABC Flexible Ventilation Tubing, ABC Brattice Cloth and ABC Powder Bags. Write to American Brattice Cloth Corp., 230 South Buffalo St., Warsaw, Indiana for your copy. Use reader service card.

A NEW AUTOMATIC LINE OILER made of aluminum, which shuts-off the air supply when the oil is used up is now being manufactured and marketed by the Le Roi Division, Westinghouse Air Brake Co., Milwaukee, Wisconsin. To find out more on this unique device write the Le Roi Division at the above address. Use reader service card.

SLUSHER BULLETIN: Alloy Steel & Metals, 1862 E. 55th St., Los Angeles, California, have recently released a new 8-page bulletin (No. 287) which describes their complete line of Pacific "Slushmaster" Scrapers. Designed especially for underground work, fifteen lightweight and heavy duty models are featured, including the new 3-D series for slot and scram operations. Also mentioned are scraper accessories and other Pacific mining products. Write to company for your copy.

List information you want MINING WORLD to obtain for you on this card. WE'LL DO THE REST. NO postage necessary if mailed in U. S.

United States

Personalities in the News——

RUDOLPH C. GEBHARDT, geologist and mining engineer, has been named manager of the mining division of the E. J. Longyear Company, Minneapolis, Minnesota. Mr. Gebhardt succeeds DR. DONALD M. DAVIDSON, who is now president. He was formerly senior geologist and mining engineer in charge of Longyear's consulting office in Denver, Colorado. As head of the Mining Division in Minneapolis, Mr. Gebhardt will have charge of geological and mining consultation involving mineral exploration and appraisal.

P. J. O'Brien has been appointed vice president in charge of production and engineering with United States Borax & Chemical Corporation, Los Angeles, California. **R. F. Steel** has been appointed vice president, finance and administration. Mr. Steel, who was recently promoted from secretary and treasurer to assistant general manager, has been with the company for 12 years. Mr. O'Brien has served as general manager of U. S. Borax & Chemical Corporation since its formation in 1956, when the Pacific Coast Borax Company merged with the United States Potash Company.

Stuart S. Merwin, consulting geologist of Golden, Colorado, has been elected vice president and director of Realty Uranium & Mining Company, Denver, Colorado. Mr. Merwin succeeds **Ray N. Peterson**, former vice president, who will continue to serve as a director.

Stanley M. Lane, former superintendent of American Smelting & Refining Company's plant at East Helena, Montana, is now general manager of the plant. **K. D. Loughridge**, former assistant superintendent of the El Paso, Texas plant, succeeds Mr. Lane as superintendent. Former general manager at East Helena was **Joseph T. Roy**, now general manager of ASARCO's plant at Selby, California.

Eugene Lindsey, formerly employed with the Anaconda Company, is now associated with Wisser & Cox, consulting geologists of San Francisco, California. Mr. Lindsey recently completed two years graduate study in geochemistry and rock alteration at the University of California.

JAMES F. SMITH (right) is now manager of the Anaconda Aluminum Company Reduction Works at Columbia Falls, Montana, succeeding HOWARD G. SATTERTHWAITE who has retired. Mr. Smith has been associated with Anaconda since 1926, and prior to his assignment at Columbia Falls, he was assistant superintendent of Anaconda's Great Falls, Montana copper refinery. Mr. Satterthwaite had been in charge of the aluminum plant since construction began in 1952.

Fayette Brown, Jr. has been appointed vice president in charge of mining and lake transportation of iron ore for the Shenango Furnace Company with headquarters in Pittsburgh, Pennsylvania. Mr. Brown formerly served as assistant vice president, mining and research, with the Cleveland-Cliffs Iron Company, Cleveland Ohio.

Dr. Nathan M. Levine, mining engineer, has accepted a position with the Technical Division Development Department of Stein Hall & Company, New York. Dr. Levine was most recently employed with the Howe Sound Company, Salt Lake City, Utah, working on beneficiation problems of copper and cobalt ores.

John Foucault, former superintendent of Cleveland-Cliffs Iron Company's Holman-Cliffs mine at Coleraine, Minnesota, has been appointed manager of the company's Minnesota mines, succeeding **Hugh J. Leach** who is now manager of Michigan mines. **Stanley W. Sundeen**, former manager of ore development, is now manager of research and iron ore development for Cleveland-Cliffs with headquarters in Ishpeming, Michigan.

Victor Gregory Macres has accepted a position as assistant professor in the newly created department of metallurgical engineering at Stanford University, Palo Alto, California.

Stanford V. Smith has been named superintendent of Susquehanna Ore Company, Hibbing, Minnesota, succeeding **Merlyn G. Woodle** who has resigned. Mr. Smith has been employed by Susquehanna since 1953.

Charles A. Steen, president of Utex Exploration Company and vice president of Uranium Reduction Company, Salt Lake City, Utah, has filed as candidate for Republican senator for Utah's 12th District.

Douglas Baker, leach department operating superintendent at Bunker Hill Company's electrolytic zinc plant, Kellogg, Idaho, has also assumed duties as operating superintendent of the cadmium plant, replacing the late **Walter J. Leamy. Kenneth A. Hart** has been promoted from leach department shifter to foreman, and **William George** and **R. J. Smith** are now shift bosses in the same department. **Robert L. Bird**, former research metallurgist, is now foreman of the roaster department.

Bill Hand, operator of the Hand Mines near Dillon, Montana, has been elected president of the Beaverhead Mining Association, Montana.

John W. Barnes, chief of the planning evaluation branch, Source Material Procurement Division, U. S. Atomic Energy Commission, and John Klemenic, process manager in the same division, were recently awarded superior performance certificates and $300 in cash for outstanding service to the government. Both men are attached to the Operations Office at Grand Junction, Colorado.

JOHN D. MACKENZIE has been elected chairman of the board of American Smelting & Refining Company, filling the vacancy caused by the death of the late KENNETH C. BROWNELL. Mr. MacKenzie will continue to serve as president of the company. He is also director of Revere Copper & Brass, Inc., General Cable Corporation, Southern Peru Copper Corporation, and Western Phosphates, Inc.

Paul H. Floyd, mineral process engineer formerly in charge of the U. S. Bureau of Mines, ore dressing laboratory at Albany, Oregon, has accepted a position with Stanford Research Institute's Chemical Engineering Section. In his new position, Mr. Floyd will conduct research in mineral processing and beneficiation.

Robert A. Watson, formerly associated with Petty Geophysical Engineering Company, has been appointed field service engineer in the Rocky Mountain area, with headquarters in Casper, Wyoming.

Peter S. Jack, metallurgical engineer at Potash Company of America's refinery at Carlsbad, New Mexico, has been promoted to the newly created position of general refinery foreman. Mr. Jack has been employed with Potash Company for the past 18 months, and formerly served with Brittania Mining & Smelting Company, Ltd. at Brittania Beach, British Columbia, Canada.

W. H. Winn has been named superintendent of the new smelter being constructed at Hayden, Arizona by the Ray Mines Division of Kennecott Copper Corporation. Mr. Winn formerly served as smelter superintendent at Kennecott's Chino Division in New Mexico.

Robert P. Koenig, president of Cerro de Pasco Corporation, was recently awarded an honorary degree of Doctor of Engineering from the Montana School of Mines, Butte, Montana.

DONALD J. DRINKWATER has been appointed manager of the Mine & Smelter Supply Company's new manufacturing division, formed by consolidation of the company with its subsidiary, Colorado Iron Works. Mr. Drinkwater was formerly assistant manager of the Marcy Mill division. In the future all products of both companies will be manufactured by the parent company. The sales, engineering, and production departments of the two companies will also be combined.

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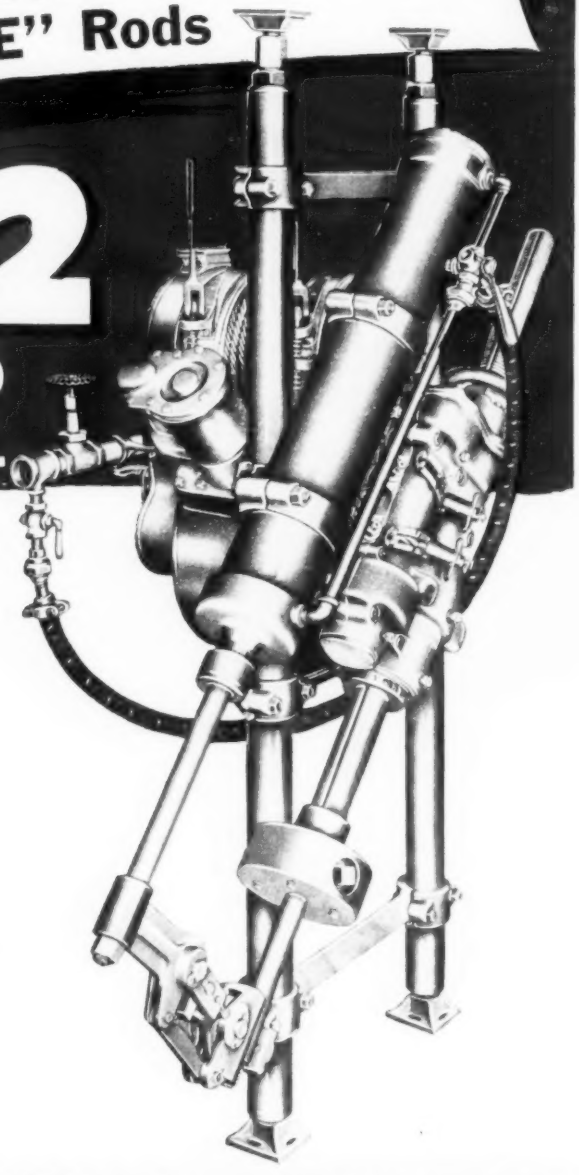

The BBU-2 is unexcelled for deephole underground drilling. It is sturdily constructed yet light in weight for its capacity. Maintenance costs are low. "A" size, gear feed (4) swivel-head. Available with cable hoist and/or single or dual 5 1/8 inch (piston diameter) rod pullers. Capacity 1800 ft. with "E" rods, 1400 ft. with "A" rods, 1000 ft. with "B" rods. Net weight range 980 to 1090 pounds.

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Newsmakers in International Mining

LEWIS B. HARDER (right), president of South American Gold & Platinum Company, New York, has been elected chairman of the board of International Mining Corporation, New York. JOHN D. SIMPSON and JOHN W. AUSTIN, president and vice president, respectively, of Placer Development Ltd., Vancouver, British Columbia, Canada, were also elected to the board.

G. S. Giles, former manager of the Rhokana Corporation, Ltd., Nkana, Northern Rhodesia, has been appointed general manager of Nchanga Consolidated Copper Mines, Ltd., Chingola, Northern Rhodesia, succeeding the late **Lawrence Allen**. Mr. Giles was previously associated with the Anglo American Corporation in South Africa, and was appointed manager of Rhokana Corporation in 1956. **Dr. W. J. DeVilliers**, former assistant manager, will replace Mr. Giles at Rhokana.

Dr. Armine F. Banfield, who has served eight years as an associate with Behre Dolbear & Company, New York, has been admitted to the partnership and is presently on assignment in Iran.

Dr. George Aletan, formerly associated with C-O Brunswick Mining & Smelting Corporation, Ltd. at Bathurst, New Brunswick, is now attached to the Department of Mining & Metallurgy, Nova Scotia Technical College at Halifax, Nova Scotia.

W. A. Triggs is now employed by Birkett Creek Mine Operators, Ltd. at Merritt, British Columbia, Canada. Mr. Triggs was formerly chief engineer with Canadian Exploration, Ltd. at Salmo, British Columbia.

Tom T. Heywood, mining engineer, has accepted a position with Sematan Bauxite Ltd. as mine superintendent of the company's operations at Kuching, Sarawak.

Dr. Troy L. Pewe has been appointed head of the department of geology at the University of Alaska, College, Alaska. Prior to this appointment, Dr. Pewe served as geologist-in-charge, United States Geological Survey, Alaskan Geology Branch. He recently returned from a season in the McMurdo Sound area of Antarctica where he was in charge of a glacial geology party for the U. S. National Committee for the International Geophysical Year.

WILBUR JURDEN has been named president and chief engineer of Anaconda-Jurden Associates, Inc., New York, a newly formed subsidiary of the Anaconda Company. Mr. Jurden was formerly Anaconda's chief design engineer and supervised such projects as Anaconda's El Salvador sulphide copper plant in northern Chile, Erie Mining Company's commercial taconite plant, and Phelps Dodge Corporation's Morenci reduction works. The new organization offers complete service in planning, designing, engineering, and construction of industrial plants of major size.

D. M. Giachino has been appointed operations liaison engineer for Little Long Lac Gold Mines Limited, with headquarters at Toronto, Canada. Mr. Giachino was formerly manager of Bevcon Mines Limited, also of Canada.

Guy E. Ingersoll, consulting mining engineer of El Paso, Texas, recently made an examination of a mineral deposit in the State of Colima, Mexico.

David Kerr-Cross, formerly of Toronto, Canada, has accepted an appointment with the United Nations Technical Assistance Administration, and will be in India for the next two years.

Thomas V. Baines was recently appointed consulting geologist for the International Nickel Company in Africa. Mr. Baines has been associated with International Nickel since 1951, and has been engaged in mining geology and exploration work in various parts of Africa.

Leopoldo Abad, formerly chief of the Philippine Bureau of Mines mining and metallurgical division, is now assistant director of mines.

B. A. Miller has been appointed a director of Specialised Employee Selection Limited, London, England, a company which specializes in staff selection.

R. W. Lund, mine superintendent at Nchanga Consolidated Copper Mines, Ltd., Northern Rhodesia, has been transferred to the Rhokana Corporation, where he will also serve as mine superintendent. **B. A. Tregay** will replace Mr. Lund as Nchanga mine superintendent.

A. R. Cator has been appointed to succeed **H. J. C. Arndt** as manager of South Roodepoort Main Reef Areas, Ltd., Johannesburg, South Africa. Mr. Cator is also manager of Ellaton Gold Mining Company, Ltd., at Johannesburg.

J. H. Polglase, general manager of Tronoh Mines, Malaya, is currently in London, England, where he will serve as representative of the Federated Malayan States Chamber of Mines and the All-Malayan Chinese Mining Association at the International Tin Council meeting. The meeting will decide on permissible export amounts of tin for the period from September to December of this year.

An official Indian delegation, headed by **D. Sandilya**, joint secretary of the India Ministry of Commerce & Industry and managing director of the State Trading Corporation, arrived in Tokyo, Japan recently for discussions with the Japanese steel industry on the supply of Indian iron ore during 1958-1959. Other members of the delegation are: **Dr. H. R. Dewan**, director, Indian Bureau of Mines; **A. N. Kaul**, financial adviser and chief accountant, State Trading Corporation; **Dr. S. N. Sen**, divisional manager, State Trading Corporation; and **D. P. Dhanda**, also associated with STC.

FRANC R. JOUBIN (right) has been named president of Bralorne Mines Limited, Vancouver, British Columbia, Canada, succeeding AUSTIN C. TAYLOR who has resigned after 27 years of service with the company. Mr. Joubin, a consultant for the Rio Tinto Mining Company, Ltd., is credited with initial discovery of the Blind River uranium field in Canada. GEORGE KIDD, Bralorne director and vice president, has also resigned and will be replaced as director by JOHN B. AIRD.

R. C. Ashenhurst has accepted a position as secretary-treasurer of Stanleigh Uranium Mining Corporation Ltd., Toronto, Canada. Mr. Ashenhurst was previously employed as secretary-treasurer of Miliken Lake Uranium Mines Ltd., Toronto.

Mary A. Marsman has been re-elected president of the Palawan Quicksilver Mines, Inc., Manila, The Philippines. Other officers also re-elected are: **G. H. Newman**, vice president; **A. L. Velilla**, secretary; and **F. H. Burgess**, treasurer.

Harry Nedwick, formerly of Ruth, Nevada, has accepted a position with Benquet Consolidated, Inc. and is now serving in Baguio, The Philippines.

G. W. H. Relly is now manager of the Anglo American Corporation of South Africa, with headquarters in Johannesburg, Union of South Africa.

Albert Hopkins has established a consulting firm, called Hopkins Mining Consultants Limited, with headquarters at Suite 102, 33 Melinda Street, Toronto, Canada. Mr. Hopkins is acting president of the firm; **I. V. Dellio** is vice president; **H. C. Washburn**, secretary-treasurer; **Fred Dunn** is chief engineer; and **Ralph Hutchison** serves as chief geophysicist.

DR. SCHRADE F. RADTKE has been appointed director of the joint research program currently being initiated by world-wide lead and zinc producers. Dr. Radtke has been chosen to manage research projects under the direction of the Industry Development Committees of the American Zinc Institute, Inc. and the Lead Industries Association. As research director, he will develop plans governing research projects of the respective associations.

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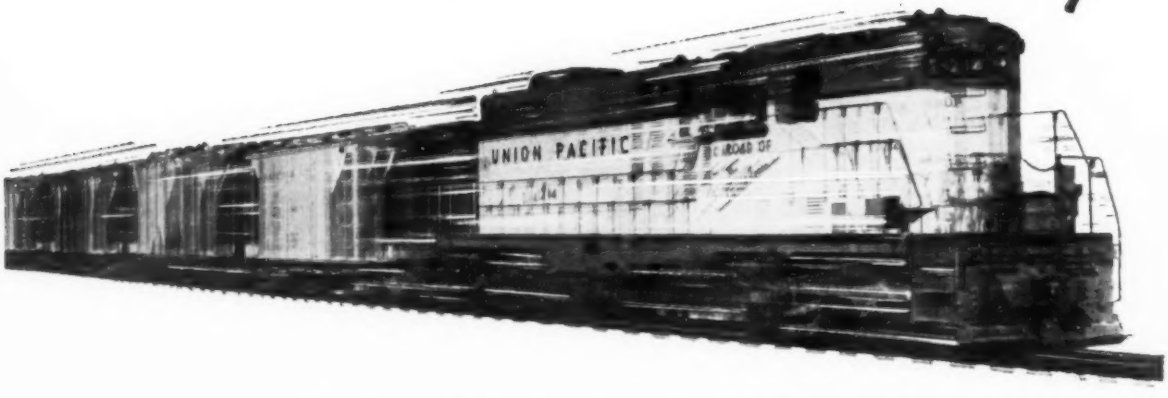

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precipitates—CENTRAL AND EASTERN

The *Meramec Mining Company* is sinking is second shaft at Pea Ridge, Missouri. The No. 2 will be located 1,000 feet north of the No. 1, and will also be a 19-foot, one-inch circular shaft, concrete lined, and planned for a depth of 3,000 feet. No. 1 headframe and hoist were purchased from the *Idaho Maryland Mines Company* which had used them at Grass Valley, California. No. 1 collar is 880 feet above sea level. The No. 2 collar will be 900 feet above sea level. It will be equipped with three friction type hoists. The anticipated daily hoisting program is to be 12,000 net tons of iron ore per day. Meramec is a joint undertaking of *Bethlehem Steel Company* and *St. Joseph Lead Company*.

The 14th Annual Convention of the *Magnesium Association* will be held at the Fort Shelby Hotel in Detroit, Michigan, October 16 and 17. The magnesium industry is completing 40 years of commercial production. Its theme at this convention will be "Magnesium Looks Ahead," and speakers will describe their part in projecting magnesium into the metal panorama of the future.

The *Jersey Quarry Company* discovered diamonds in Illinois recently on property owned by George Hofstetter of Jerseyville, Illinois. The diamonds were found in soapstone strata 155 feet below the surface. Tests verifying the discovery were made by the *Central Illinois Testing Laboratories* in Springfield. The stones are tiny specks, discovered when a drill broke as it tried to penetrate a 30-foot stratum of black rock. Other attempts to drill through the stratum have failed. The diamonds may be suitable for commercial use in cutting tools.

The *Eighth Annual Drilling and Blasting Symposium* will be held at the *University of Minnesota's Center for Continuation Study* on October 2, 3, and 4.

The $1,2000,000 addition to the metals research building at *Armour Research Foundation of Illinois Institute of Technology* will be dedicated October 20, making completion of the second step in the 10-year expansion program of the Foundation started early in 1956. The four-story addition will more than double the amount of previously available space for metals projects. It will be used by the research sections on electrochemistry, and applied, powder, reactor, physical, and nonferrous metallurgy. The original metals building will be devoted to pilot plant and other large scale operations.

Republic Steel Corporation has reopened its iron mines at Lyon Mountain and Mineville, New York. According to the firm, the demand for pig iron and steel has picked up. The Lyon Mountain was closed in December 1957, and the Mineville operation had been idle for the past six months.

The *General Services Administration* has announced that the final date for applying for participation in the beryl ore buying program has been extended to December 31, 1961. Previous deadline had been June 30, 1958. Termination date for the program is June 30, 1962, or when 4,500 tons of beryl ore have been purchased, whichever occurs first. As of June 30, 1958, about 2,000 tons had been purchased.

New Jersey Zinc Company is undertaking a major construction program at its Palmerton, Pennsylvania smelter. The new facilities will allow the company to materially increase its ore roasting capacity, and to expand production of sulfuric acid by over 40,000 tons a year. The $5,-000,000 program is to be completed in 1959. The additional roasting capacity was needed to handle the large volume of sulfide ores coming from the company's mine in Virginia and its new mines in Pennsylvania and Tennessee.

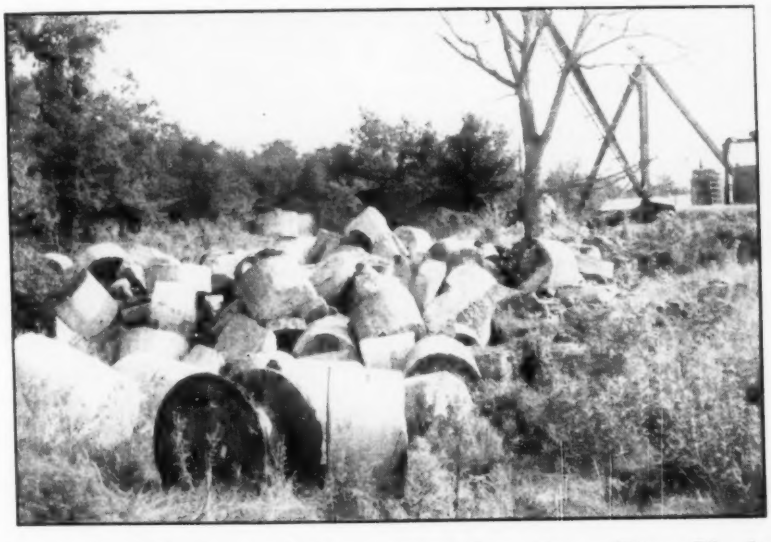
The *Penobscot Mining Corporation* of Harborside, Maine is exploring the *Cape Rosier* property in Brooksville township, Hancock County, Maine. There are four shafts on the property, and from July 1881 until September 1883, about 10,000 tons of ore were mined averaging 20 percent zinc, 2.8 percent copper, and some lead. From crude ore hoisted, about 3,000 tons of hand sorted ore were shipped. In 1940 and 1941, *St. Joseph Lead Company* drilled 13 holes on the property, and in 1942, the *U.S. Bureau of Mines* drilled another nine holes. The deposit occurs as lenses of mixed sulfides replacing highly sheared and altered agglomerate.

American Zinc Company of Tennessee is now producing 150 tons of zinc ore daily from the *Coy* mine at Jefferson City, Tennessee. The Coy mine shaft was started more than three years ago, but ground water in cavernous limestone had repeatedly halted development work. The mine is being developed to produce 1,000 tons per day. This is the fifth new zinc mine to be developed in the Tennessee zinc district since 1950.

The first of two new aluminum metal making potlines has been placed in production by *Aluminum Company of America* at Massena, New York. The second is scheduled to start on October 15. Combined initial capacity will be 54,000 tons of aluminum per year. This completed the first phase of the $25,000,000 modernization and expansion being undertaken by Alcoa to utilize power from the new St. Lawrence River project. Later this year, the company will also reactivate two lines which have been idle, providing an additional 36,000 tons of metal annually.

Mica miners in the Spruce Pine area of North Carolina are protesting the sample system set up by the government for use in grading mica. They say that these samples are not representative of the mica produced in western North Carolina. It is also alleged that the samples furnished for use at Spruce Pine required a much higher standard for grading of mica to be purchased there than is the case for imported mica. A committee has been named to represent Spruce Pine in talks with proper authorities on the grading problem.

The lead and zinc industries' joint research program is getting underway with



Here's 600 Feet of Core from American Zinc Shaft

American Zinc Company of Tennessee has completed drilling its 66-inch-diameter ventilation shaft at the Young mine to a depth of 600 feet and has installed a 100,000-cubic-foot-per-minute ventilation fan at the collar. This Jeffrey fan, driven by a 150-horsepower motor, assures adequate air to stopes through a 2400-foot-long haulage level driven from the Howard hoisting and operating shaft. The picture shows some of the drill cores from the shaft stacked on the dump. The stiff leg hoisting derrick used as a headframe during drilling may be seen at top right. Jack Gilbert supervised the bore hole at New Market, Tennessee.

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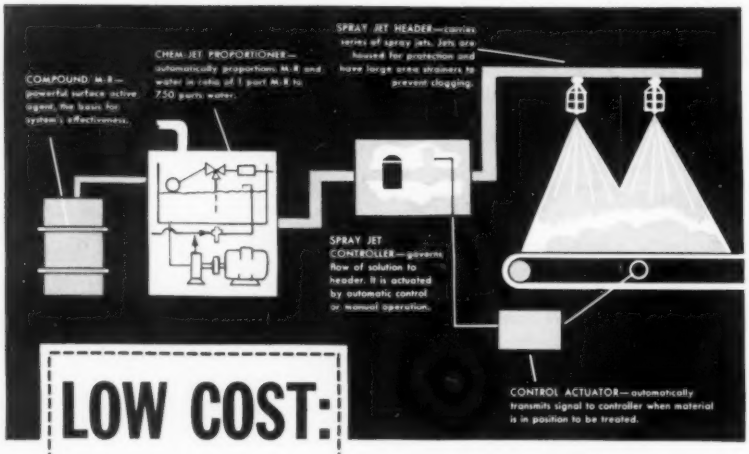
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the appointment of a director, Dr. Schrade F. Radtke. (See page 55 of this issue for further details on Dr. Radtke's appointment.) The joint program has the support of lead and zinc producers in Australia, Canada, Britain, Mexico, South America, and the United States. These companies are: *American Metal Climax, Inc.; American Smelting and Refining Company; American Zinc, Lead and Smelting Company; Anaconda Company; Athletic Mining & Smelting Company; Broken Hill Associated Smelters Pty. Ltd. (Australia); Bunker Hill Company; Cerro de Pasco Corporation; Combined Metals Reduction Company; Consolidated Mining and Smelting Company of Canada, Ltd.; Consolidated Zinc Corporation (England); Eagle-Picher Company; Electrolytic Zinc Company of Australia; Hudson Bay Mining and Smelting Company Ltd.; Matthiessen & Hegler Zinc Company; National Zinc Company; New Jersey Zinc Company; St. Joseph Lead Company; United States Smelting Refining and Mining Company.* In cooperation with the Technical Steering Committees of each Association, Dr. Radtke as research director will develop plans governing the research projects of the respective associations and will recommend the degree of emphasis to be placed on fundamental and applied research. No limit has been set by the sponsoring producers on expenditures for research. Funds will be provided for any project receiving approval of the respective Industry Development Committees.

Approval for the construction of a scrubber-fines treatment section to the Holman plant has been granted by the board of directors of *Cleveland-Cliffs Iron Co.* This addition will be used primarily for recovery of fine iron ores and will supplement the present HMS and HMS cyclone separation circuits at this plant. Construction is scheduled for the winter of 1958 with completion estimated by May 1959.

Lake Superior iron ore shipments at the end of August totaled 9,324,061 gross tons, compared with 13,172,356 gross tons at that same time in 1957.

The Attorney General of Wisconsin, Stewart Honeck, has recommended that discussions be started with *Ashland Mining Company* to determine whether present water use laws would allow the company to meet its needs for the proposed taconite operation near Butternut. He said that the state should find out if it can assure an adequate water supply for the mine in advance of new legislation. He also stated that conservation interests would not be damaged by the project.

A hearing was held before the *Minnesota Interim Legislative Commission on Water Polution* regarding the affect of taconite tailings entering Lake Superior from the *Reserve Mining Company's* plant at Silver Bay. The majority of witnesses appearing before the committee reported that tailings were unharmful to the fish and the lake. A report will be presented to the state legislature in January.

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"Our engineers specified USS 'T-1' heat treated alloy steel in the construction of our 4-in-1 skid shovel bucket because we could reduce the original weight by 35%. What's more, we could add one-half yard to the bucket capacity," says Mr. Edward Drott, President and Chief Engineer, Drott Manufacturing Corporation, Wausau, Wisconsin.

The entire Drott bucket is fabricated from USS "T-1"* Steel which has a minimum yield strength of 100,000 psi, nearly 3 times that of structural carbon steel. This strength helped to make the weight reduction possible . . . and the reduced weight on the front end of the tractor improved the balance and increased efficiency.

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Vitro's Wyoming Property May Go To Susquehanna

Stockholders of The Susquehanna Corporation of Chicago, Illinois are considering the acquisition of the mining properties of Vitro Minerals Corporation in the Gas Hills area of Wyoming. Vitro Corporation of America and Rochester & Pittsburgh Coal Company, joint owners of Vitro Minerals, have already approved the combining of these uranium interests.

Susquehanna is the parent company of Fremont Minerals Inc. which is building a new 550-ton mill and acid plant in Riverton, Wyoming. Fremont has applied to the AEC for permission to increase this designed capacity to 1,000 tons. Much of this uranium ore would come from the Vitro properties where expanded mining activity would be undertaken as soon as AEC approval was forthcoming.

Vitro's properties in Wyoming are estimated to contain more than 911,000 tons of ore. This estimate, made by the AEC, is based on exploration and development of about 22 percent of the more than 40,000 acres presently controlled by Vitro in the Gas Hills area.

The merging of the interests would be through an exchange of stock. Susquehanna would acquire all of the capital stock of Vitro Minerals, and, in turn, the parent companies of Vitro Minerals would receive a large ownership in Susquehanna. Susquehanna has another uranium subsidiary in South Dakota, where Mines Development operates a 400-ton-per-day uranium mill in Edgemont.

Mining of uranium ore in the Gateway area of Beaver Mesa, Colorado will be undertaken by *Pacific Industries Inc.* Until now, Pacific Industries has operated, through its subsidiary *Flanders Mining Company*, only as owner and lessor of its uranium interests in this area. Lessees have done the actual mining under royalty arrangements. The company believes that it can mine for profit in the Gateway area exceeding the royalty income.

The *Mountain King* gold-silver-lead-zinc-copper mine in the Red Mountain Pass near Ouray, Colorado is being rehabilitated. Production is expected to start when the price picture improves. Keith Johnson is general manager.

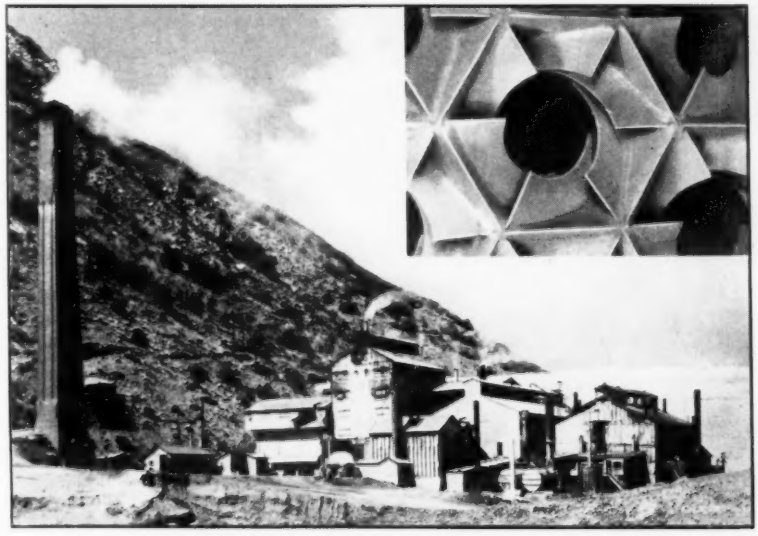
Marcy-Shenandoah Corporation has completed rehabilitation of the selective flotation mill at Silverton, Colorado and the mill is ready to receive shipments. The Central mill (formerly Shenandoah Dives) has a daily capacity of 750 tons of ore. It is equipped to produce concentrates of lead, copper, and zinc, using both flotation and gravity processes.

Denver-Golden Oil & Uranium Company reports that it is making good progress on a gold mining operations in the Clear Lake region near Silverton, Colorado. A crosscut is being driven and should reach the vein shortly. Assays have shown that the heart of the vein runs as high as 3 and 4 ounces in gold. The company has staked 20 claims in the area and the group is called the *Burbank*. The firm is also operating the *Schwartzwalder* uranium mine near Golden.

The *Second National Energy Resources Conference* will be held in Denver, Colorado on October 15 through 17. All of the major energy fields will be discussed by pre-eminent authorities, including such sources as solar energy, coal, oil shale, atoms, astronautic energy, nuclear power, and "sustenance from the sea."

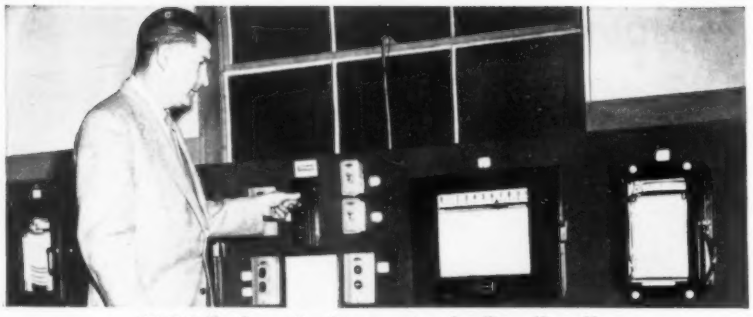
Utah Copper Division of *Kennecott Copper Corporation* has awarded a $5,000,000 stripping contract to *Western Contracting Corporation* of Sioux City, Iowa for removal of 4,000,000 to 8,000,000 cubic yards of overburden from the upper levels of the east and west sides of the mine at Bingham Canyon, Utah. Work is to start this month and will take about one year. A $500,000 contract for haulage of 400,000 yards of fill material needed to raise the dike around the tailing ponds of the Arthur and Magna mills was awarded to *Gibbons and Reed Construction Company* of Salt Lake City. In addition to the stripping contract, Utah Copper itself will move about 17,000,000 yards of waste material this year. These projects enable the company to maintain its present two-to-one stripping ratio.

The AEC and the *Texas-Zinc Minerals Corporation* have amended and extended their contract for treating of uranium ores from independent producers in the Mexican Hat area of Utah. The original Mexican Hat contract called for treatment of about 4,600 tons of custom ore per month; the amended contract increases this to about 13,000 tons. Reserves in the White Canyon-Monument Valley area were estimated at 1,869,000 tons as of November 1, 1957. The contract also provides for purchase of Commission-owned ore stockpiles at White Canyon, Utah, and extension of the contract from March 1962 to December 31, 1966. This is the first such action by the AEC to implement the policy announced in April for expanding to a limited extent domestic uranium procurement, thus providing markets for those areas which had no

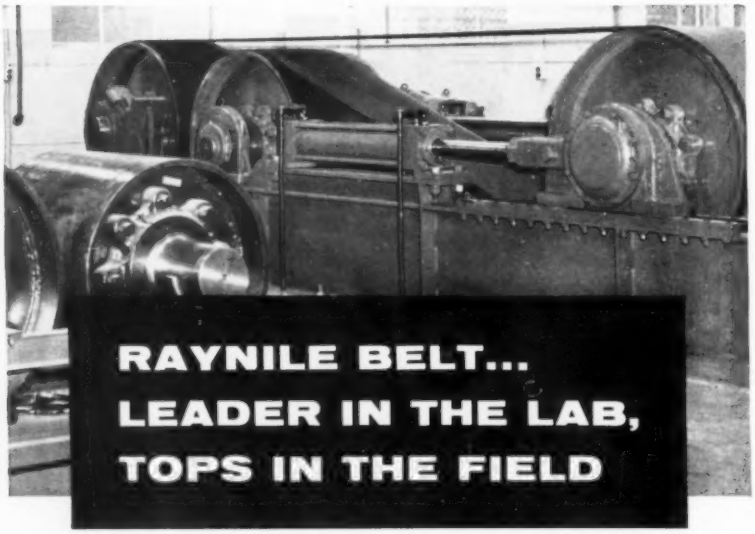


New Uranium Dust Recovery Method Tested by VCA

At the Durango, Colorado plant of Vanadium Corporation of America, an interesting attempt at solving the dust recovery problem has been underway for the past year. Located 6,500 feet above sea level, the Durango mill (pictured above) operates on a 24-hour basis extracting uranium and vanadium from carnotite ore mined in western Colorado and Monument Valley, Arizona. Just before the ore reaches the acid leach stage of the reduction cycle, the dust problem has reached maximum intensity within the plant. Greatest sources of dust loss to the atmosphere are at conveyor inlets and outlets to rod mills and at vibrating sorters. Although the solid ore contains less than 1.0 percent uranium, the ore dust yields a considerably higher percentage because of friable characteristics of carnoite. In March 1957, Vanadium officials began a search for a dust collector that would not only provide a minimum 95 percent collection efficiency, but also would give continuous trouble-free service. It was decided to experiment with an unusual and relatively new aerostatic unit manufactured by Hagen Chemicals & Controls Inc. of Pittsburgh. Hoods, with ductwork leading to the collector inlet, were installed before and after the rod mills and at the vibrator. Two 10-inch blowers powered the overhead dust recovery network. Using dust samples taken directly from the mill exhaust stack, overall efficiency was calculated at 97.7 percent. After a year of service, there has been no sign of wear or tube plugging; in fact, the unit is actually self-cleaning. The closeup view of the hexagonal inlet nozzle in the upper right area of the picture shows why. The honeycomb design leaves no flat waste areas to encourage deposits and tube plugging. All surfaces slope at steep angles into the vanes and are constantly swept by swirling dust at continuously increasing velocities.



50,000 lb. thrust load torture test for Raynile splice.



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markets, or had an inadequate market for ore reserves developed prior to November 1, 1957.

Kennecott Copper Corporation's Western Division has announced a production increase of 12 percent for its mines in Utah, Nevada, Arizona, and New Mexico. The work week has been lengthened from four to six days which will increase finished copper output from 26,100 tons to 29,900 tons. Prior to this, Kennecott had cut back its U.S. mine output three times during 1958, lowering production to about 259,500 tons annually. In 1957 output had been 387,291 tons; the new rate restores it to about 358,800 tons annually.

Hecla Mining Company has completed the 2,000-foot crosscut from the *Radon* uranium mine to the adjoining *Hot Rock* claims in the Big Indian district of San Juan County, Utah, where an ore body had previously been outlined by drilling. The ore body is estimated to contain 35,000 tons of 0.37 percent U_3O_8 ore. *Radorock Resources Inc.*, which owns Radon mine, will receive 50 percent of the net operating profits from this ore body after Hecla has been reimbursed for development work. The Radon mine shipped 69,720 tons of 0.774 percent U_3O_8 during the fiscal year ended April 30, 1958. Hecla operates this mine for Radorock, and receives 25 percent of the net profits. Latest estimate of the ore remaining as of April 30 was about 430,000 tons averaging 0.73 percent U_3O_8. A new milling contract is being completed between Radorock and the *Uranium Reduction Company*, pending satisfactory arrangements between Uranium Reduction and the AEC.

WYOMING

Union Carbide Nuclear Corporation, through merger of stock with *Globe Mining Company*, has acquired the valuable Gas Hills, Wyoming uranium properties of the latter firm. Globe Mining Company had an *Atomic Energy Commission* production allocation of 250 tons of ore daily. By the acquisition, Union Carbide now has accumulated a daily allocation of 492 tons in the Gas Hills area where the firm has already announced its intention to construct an upgrader unit and 500-ton mill.

Uredco Associates Limited, formed last January to explore and develop the Rim Group uranium claims in the Gas Hills of Wyoming, has transferred its properties to *Western Uranium Corporation* of Belle Fourche, South Dakota. Terms include an undisclosed down payment and a $750,000 production payment. The *Atomic Energy Commission* had given Uredco Associates rated reserves of 55,000 tons of 0.28 percent uranium ore as of November 1, 1957, and an allocation of 75,000 pounds of U_3O_8 a year.

The *Columbia-Geneva Steel Division* of *United States Steel Corporation* has been issued the patent for 2,300 acres of Shoshone Forest land in Fremont County, Wyoming at the location of the Atlantic City taconite project. The steel firm exchanged 2,400 acres of privately owned land in Medicine Bow National Forest.

This impressive installation at Kiruna, Sweden, demonstrates a major benefit of ASEA Multi-Rope Friction Hoists: *low initial installation cost.*

Each of these ASEA Hoists has a skipload of 22 tons and is designed for a depth of 1500 feet, maximum speed 2200 feet per minute.

At Kiruna, as in mining operations throughout the world, ASEA Multi-Rope Hoists prove less costly to operate, safer, and they reduce rope wear.

In the U.S. these advantages may be seen in the ASEA installations of National Potash Co. and The Cleveland-Cliffs Iron Company.

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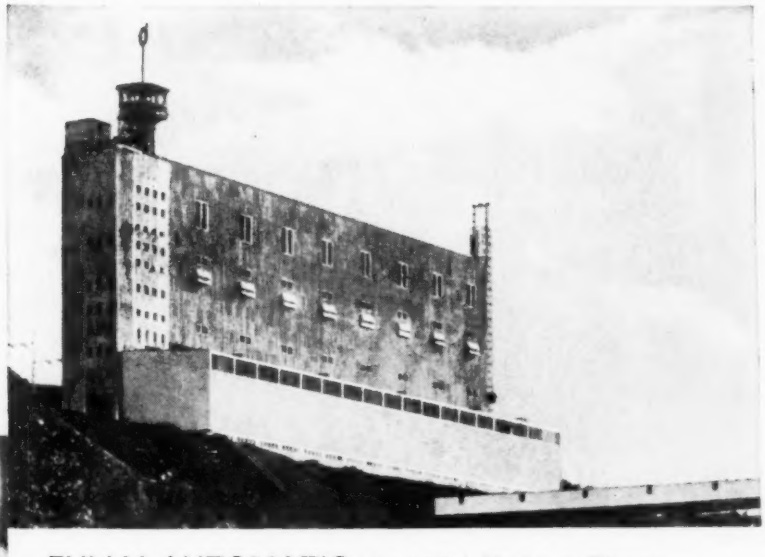

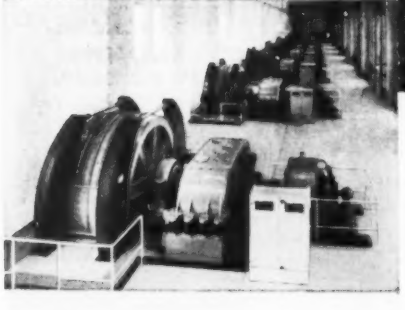

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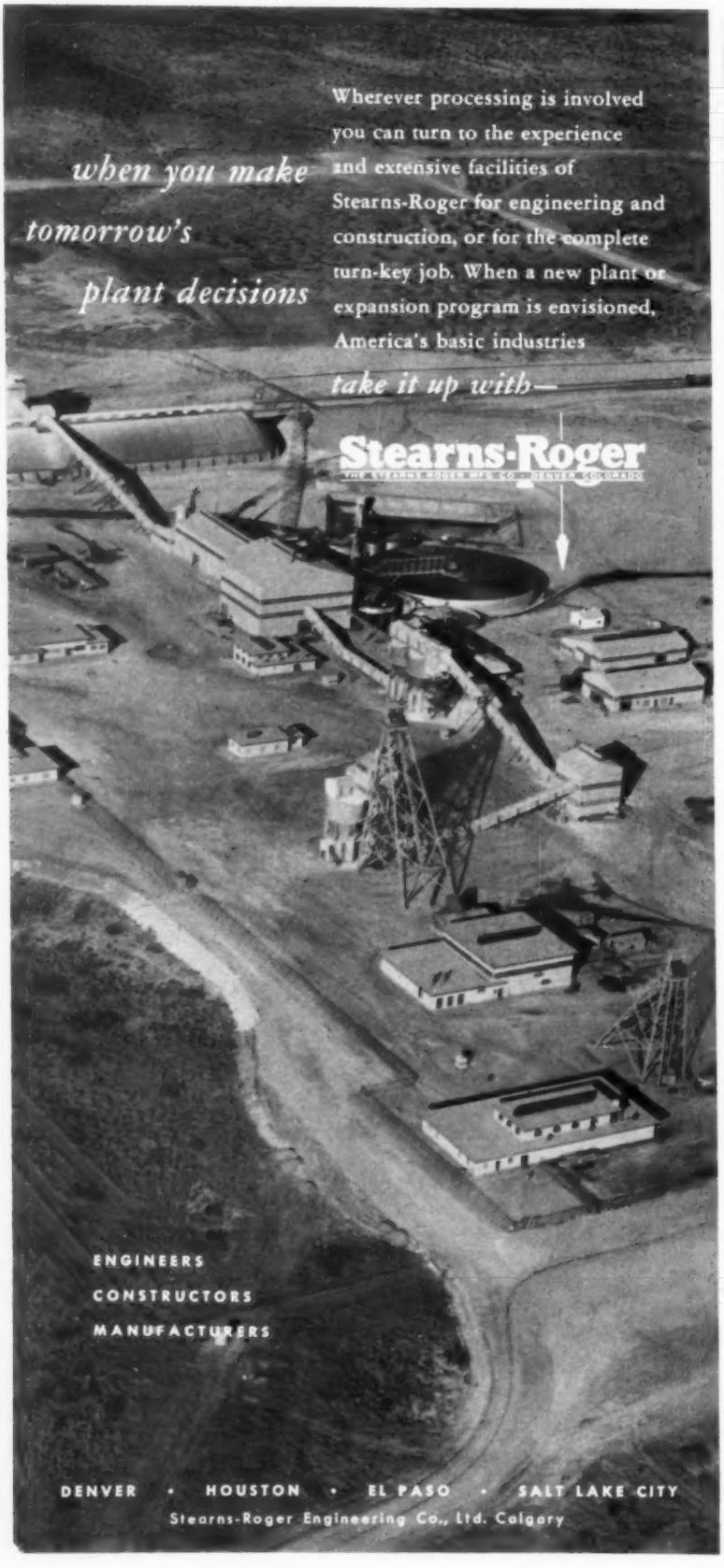
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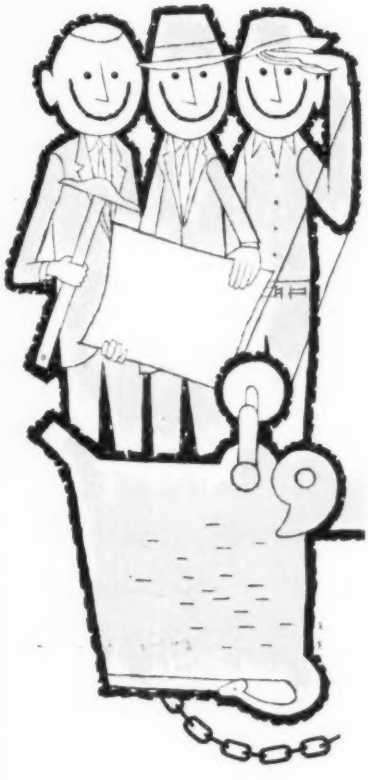

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New Separation Process Developed for Oxide Ores

A new process for separating copper, cobalt, and nickel in oxide ores by ammonia leaching and ion-exchange extraction has been developed by Luther L. Lawson and Walter R. Averett of Las Vegas, Nevada. This process is especially suited to the removal of copper from gold ores, or separation of copper from carbonate ores. tI can be modified, also, for use in separation of gold, silver, and other metals in cyanide leach, claim the process developers.

New features of the process include: the control system, which is designed especially for precise automatic operation; purity of products recovered; ability to process complex ores and retain values obtained; concentration of the product, which reduces the amount of material handled.

The amount of chemical consumption will vary with the richness of the ore, but preliminary figures indicate a cost of $10.00 per ton of ore assaying 10 percent CuO, 2.75 percent NiO, and 0.86 percent CoO. Tests show that 80 to 90 percent of the stoichiometric requirement of ammonia is recovered for recycling to leach tanks. eMtals are recovered as oxides or salts.

Mid Continent Uses New Shaft Sinking Methods

A new concept in shaft-sinking is being introduced in the Grants, New Mexico area by Mid Continent Uranium Corporation of Grand Junction, Colorado. This firm is currently engaged in sinking a 460-foot vertical shaft, the Barbara J No. 3, to reach an estimated 100,000-ton uranium ore body in the Poison Canyon area.

In place of conventional methods, Mid Continent is using circular Armco liner plate to support the walls of the hole. The plate in this case consists of corregated rings 7 feet in diameter and 18 inches high. The plates are bolted together to form a solid section through the first 55 feet of the shaft, to hold the "blow sand"—an unconsolidated, fine material which covers the surface of the area. Below the initial solid section, the rings are then spaced on 6-foot centers. The separate rings are positioned directly on the broken muck pile and grouted solid to the wall rock.

Shaft sinking is under contract to Centennial Development Co. of Eureka, Utah. Upon completion, the shaft will be turned over to the Williams Mining Partnership which will mine the ore body under lease from Mid Continent.

According to Norman E. Ebbley, Vice President and General Manager of Mid Continent, the overall cost of sinking the shaft, including labor and materials, will be under $100 per foot. Although the cost of the liner plate is roughly $30 per foot, the average cost in the shaft is about $10 per foot due to the 6-foot spacing. In addition, Ebbley said, the plate will be almost 100 percent salvagable when the mine has been worked out.

Centennial is using a special Cryderman mucker (see picture) which works efficiently in the small diameter shaft. The machine was designed and built by the Shaft and Development Machines Co. of Salt Lake City, Utah.

The Barbara J No. 3 property was drilled under a Defense Materials Exploration Administration program. The drilling uncovered an ore body consisting of several separate rolls in close proximity to each other; all will be mined through

the single shaft. Ore thicknesses of from 5 to 25 feet have been indicated by the drilling with some chemical assays in excess of 1.0 percent uranium oxide.

ARIZONA

American Smelting and Refining Company has completed a planned phase of both surface drilling and underground exploration for copper at its East Pima ore body near Tucson, Arizona. The company has announced discovery of a major deposit and this work was done to determine its size, grade, rock conditions.

A large find of barite in the Big Horne Mountains, about 20 miles south of Aguila, Arizona, has been claimed by William F. Paine of Mesa, Arizona. Four Phoenix area men are associated with Paine in the development of the deposit of 12 claims. Paine said the barite is in a number of 10-foot-wide veins near the top of a mountain. He said he and his associates will either sell the property or construct a 200-ton-a-day mill.

Exploration has started on a portion of 300 lode mining claims in the Constellation area of southern Yavapai County, Arizona, by the *Black Rock Mining Corporation*, a newly formed subsidiary of *William F. Kelsey and Associates*, formerly of Albuquerque, New Mexico, and now of Wickenburg, Arizona. Silver and copper deposits are being investigated and it is expected production will result. The firm is prepared to move its 700-ton flotation mill from Ouray, Colorado to Wickenburg. Basic metals, such as copper, gold, silver, and rarer metals, such as beryl, autunite, and tantalum, are being sought in the overall program.

Mining and milling of manganese ore has been started at Bouse, Arizona by *Sunshine Mining Company*, large Idaho silver producer. The firm has acquired a half interest in a manganese concentrator at Bouse and on an adjacent manganese deposit through an agreement with *Ore Concentrates Inc.* Mining is by open-pit methods.

Phelps Dodge Corporation has increased production at its copper mines at Morenci, Ajo, and Bisbee, Arizona by returning to a five-day week; the four-day week had been in effect since June 1. It is estimated that this will increase output by 3,500 tons monthly. This is the first increase in output by Phelps Dodge after five curtailments that started in October 1956. The cutbacks had reduced production from 270,181 tons in 1956 by about 108,072 tons annually. *Kennecott Copper Corporation* has returned to a six-day week at its major western copper mines, including the Ray, Arizona division.

McFarland & Hullinger reportedly plan to suspend mining operations shortly at their *San Xavier* lead-zinc mine in the Pima district of Arizona. They also plan to hold the property since it is located in a very rich copper area.

For the six-month period ended on July 31, 1958, *Western Gold & Uranium Inc.* produced 6,394 tons of uranium ore averaging slightly more than 1.0 percent uranium oxide at its Orphan mine in the Grand Canyon of Arizona. This compares to a total of 7,303 tons of ore averaging 0.86 percent uranium oxide produced in all of 1957.

Tulsa Minerals Corporation which owns uranium, copper, and silver mining properties near Globe, Arizona, is reported to be interested in a gold property. The firm is owned by O. R. Burden, president of *O. R. Burden Construction Corporation, and J. E. Burden*, head of *Pioneer Drilling Company*.

Duval Sulphur & Potash Company has spent $9,160,000 on its *Esperanza* open pit copper mine and mill 20 miles south of Tucson, Arizona, and plans to spend an additional $10,700,000 before 1958 ends. According to a financial statement recently released by the company, an estimated expenditure of an additional $1,140,000 in 1959 would complete the job. *Isbell Construction Company* has the contract for the mine and last November began stripping 5,000,000 tons of overburden. Contract for construction of the mill is held by *Stearns-Roger Manufacturing Co.* The mine and mill are located in the foothills of the Sierrita Mountains, seven miles west of the Tucson-Nogales highway just south of Sahuarita.

CALIFORNIA

United States Borax & Chemical Corporation's Pacific Coast Borax Company Division will increase its boric acid production at Wilmington, California to meet the increased demand for boric acid in many industries and to supply imminent requirements of the boron fuel manufacturers. The division recently received contracts from two major producers of boron fuels, *Olin Mathieson Chemical Corporation* and *Callery Chemical Company*. Initial boric acid deliveries to these companies are scheduled to begin late this year. Operations at the company's new plants at Boron, California continue to show improvements. Daily tonnage goals have now been attained and in some cases surpassed. Plant recovery has been materially increased. Further improvements in operations are expected.

A fire in the Mendocino National Forest of California this summer caused $30,000 damages to the *Abbott* quick-

silver mine near Williams. Some 200 feet of tramway trestle and half of a 200-foot redwood vapor pipe were destroyed. Origin of the fire was unknown. The surface operation was shut down for two weeks while repairs were made.

Natomas Company reports that the value of the gravels dredged from its Folsom district property in California during the first half of this year was slightly better than in 1957. Three dredging units were in operation during that period. Although the gross recovery was approximately 11 percent less than the corresponding period of 1957, the recovery from the particular units now operating reflects a 10 percent increase over the comparable 1957 output.

Southern Pacific Railroad has purchased 80 new ore cars for use in hauling iron ore from *Kaiser Steel Company's Eagle Mountain* mine to its plant at Fontana, California. The cars have 50 percent more capacity than the former ore cars, and are 30 percent shorter. The shorter length is important because it permits hauling more ore on shorter, more controllable trains.

NEVADA

Eagle-Picher Company's $2,500,000 diatomaceous earth processing plant near Lovelock, Nevada has been completed. Ore will come from the large deposit 30 miles west of Lovelock which the company has on a long-term lease. John Pedro has completed stripping the overburden and a large supply of ore has already been stockpiled to insure a continuous flow of ore to the plant. John M. Kinney Jr. is manager of this plant and the one at Clarks Station near Reno. Plant superintendent is Ralph Yokum.

Combined Metals Reduction Company is still producing perlite from its mine and mill near Pioche, Nevada. The lead-zinc mines have been closed, but the perlite pit, 16 miles away, is still producing. The perlite is hauled to the Caselton mill by truck. It is then crushed, sized, and shipped on by rail to distant perlite producers for final refining.

An option on the *Mason Valley* and *Bluestone* copper mines near Yerington, Nevada has been granted to L. O. Walker and associates by Judge John R. Ross and Mrs. Julia Lothrop. Both mines were heavy copper producers in the early part of this century.

Discovery of molybdenum ore has been reported from the *Mountain City Uranium Company* property operating near Mountain City, Nevada. While driving an adit to contact a uranium vein indicated from surface drilling, the firm penetrated a molybdenum ore formation. Samples have been sent for assaying but results are not known at this time. Local mining men say it is of shipping grade. Meanwhile, the adit has been extended some 375 feet. Also in the Mountain City area, *Standard Slag Company* is making two shipments a week from the *Race Track* group property which it has leased. The company is also reported to have taken over a group of claims held by Riley Chambers and Mike Uriarte, just east of the Race Track property, and has a lease and option on the *Hot Spot* claims immediately across the river from Mountain City.

In its field work this year, the *United States Geological Survey* will make a reconnaissance geologic study to obtain data for a new state geologic map of Nevada. Information will also be compiled on mines and mineral resources of Lyon, Ormsby, and Douglas counties in Nevada.

Bristol Silver Mines Company has been making regular shipments of silver-lead-copper ore to smelters in Salt Lake City this season. The firm made an important ore discovery late last year after extensive exploration work in the Snyder shaft.

NEW MEXICO

Federal Uranium Corporation of Salt Lake City, Utah reports that 1,100 tons of uranium ore are being shipped monthly from New Mexico. Part of this comes from the newly opened sections of the Haystack Butte property in the northern part of the state.

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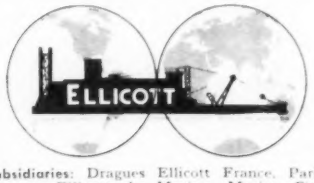

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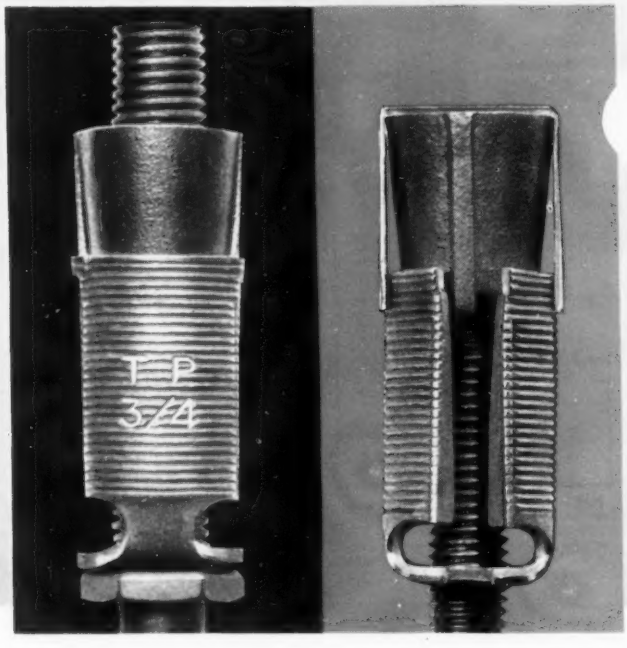

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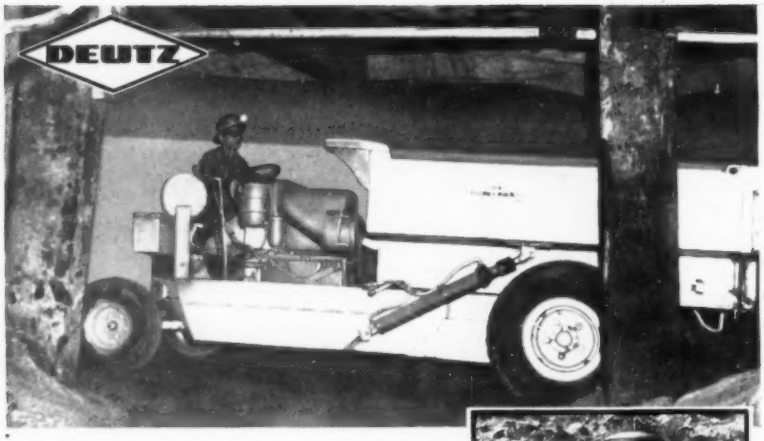

Utah Mining Truck Manufacturer Picks AIRCOOLED DEUTZ DIESELS for its Shuttle Buggies

The strenuous demands made on its mining trucks in the uranium country of the four corner area determined the selection of Deutz Air-cooled diesels by the Young's Machine Company in Monticello, Utah. Picking the quick-starting Deutz with its high fuel economy, no overheating and maintenance problems proved an invaluable aid in increasing sales for Young's.

In picking Deutz Air-cooled diesels Young's Machine Company joins a long list of American and foreign manufacturers in specifying the world's outstanding air-cooled diesel for their equipment. Only Deutz has these outstanding features:

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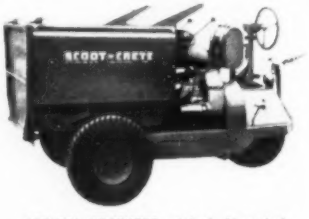
- Top running capacity at temperatures ranging from −40° to +140° F.
- Less down time because higher head temperatures end corrosive sulphurous acid condensation.
- Greater fuel efficiency due to more thorough combustion.
- Complete service and parts facilities right where you need them.

Mine installation at Rock Springs, Arizona, uses ATLAS COPCO Compressor CT-6 with Deutz–6 cylinder A 6L 514 engine to assure top running efficiency in all temperatures. The semi-portable compressor provides 320 C.F.M.



GETMAN BROTHERS picked Aircooled Deutz Diesel Engines to power its Scoot-Crete Ore Carriers designed to carry loads up to 3500 lbs. and climbing 25° grades. Deutz was chosen for reliability, high fuel efficiency and minimum downtime.

PARTIAL SPECIFICATIONS TABLE

MODEL	BHP	RPM
F 1 L 712	10/12	2000/2300
F 2 L 712	20/24	2000/2300
F 3 L 712	30/39	2000/2300
F 4 L 712	40/52	2000/2300
F 6 L 712	60/78	2000/2300
A 2 L 514	28	1800
A 3 L 514	42	1800
A 4 L 514	56/72	1800/2000
A 6 L 514	84/110	1800/2000
A 8 L 614	112/145	1800/2000
A12 L 614	170/220	1800/2000

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SOUTHWEST

A $2,000,000 skip haulage system is being installed at the open-pit copper mine of *Kennecott Copper Corporation's Chino Mines Division* in Santa Rita, New Mexico. The new installation will be completed sometime in 1959. The skip is to be installed at the southwestern end of the pit where the vertical distance from the top to bottom is about 600 feet. Two 40-ton ore buckets or skips will be loaded by trucks at a station near the bottom of the mine. At one station, the skips will discharge waste; at another station, ore will be deposited. This material will then be moved either to the lumps or the reduction plant by train. A similar installation is being made in the Nevada Mines Division pit. The procedure is relatively new in open-pit copper mining.

United States Judge Carl A. Hatch has restrained the *Homestake Mining Company* from processing custom ore from the Rio De Oro mine pending outcome of several federal court suits. He has also issued an order, restraining Homestake from moving any custom ore, now at the site of the *Homestake-New Mexico Partners* mill near Grants, to the *Homestake-Sapin* mill. He also ordered Homestake to refrain from processing in the Homestake-Sapin mill any custom ore at the site of the Homestake-New Mexico Partners mill. The restraining orders are ramifications of a suit filed by Rio De Oro against Homestake, alleging the latter has failed to pay established prices for uranium ore, and has been diverting ore from the Homestake-New Mexico Partners mill to the Homestake-Sapin Mill. Rio De Oro has an interest in the former mill. Hearings are still underway.

Rare Metals Corporation of America now estimates its *San Mateo* ore body to contain at least 1,000,000 tons averaging about 0.2 percent U_3O_8. Mining is scheduled to get under way early in 1959 at this property in the Ambrosia Lake district of New Mexico. Sinking of a 1,100-foot shaft had progressed 860 feet when it encountered water. Pumps are now handling the flow of water while corrective measures are being taken to seal off water around the shaft. Sinking will continue when the water flow has been stopped. Surface mining installations are nearly completed.

Purchases of uranium ore by the AEC have been discontinued at the Grants, New Mexico ore-buying station as of October 1. The station was no longer required now that several uranium processing plants are operating in the area.

A joint convention of the *New Mexico Mining Association* and the *Southwest International Mining Association* will be held in Carlsbad, New Mexico October 30, 31, and November 1. Technical discussions will cover new developments in mining and milling.

Twin Star Industries, Inc. of Austin, Texas is currently exploring a high-grade phosphate deposit near San Antonio, in Uvalde County. The ore body is located in Edwards limestone underneath a large cave which has been mined for bat guano for 100 years. The low-fluorine phosphate rock is formed by leaching of the guano and precipitation of the phosphoric acids as calcium phosphate at a lower level.

The newly organized Southwestern Federation of Geological Societies will meet for the first time on October 22 through 25 in Mineral Wells, Texas. Papers will stress the geologic framework of the southwest.

An ore shoot of lead-silver ore has been opened at the old *Black Bear* property on Canyon Creek north of Wallace, Shoshone County, Idaho, by following a narrow seam of high-grade. *Black Bear Silver-Lead Mines Company* is doing the work with financial backing of *Metropolitan Mines Corporation* of Wallace. The old Black Bear property consisted of seven claims, and Black Bear Silver-Lead has leased four additional claims from the *Frisco* group of the *American Smelting and Refining Company* and 25 additional claims of the *Flynn* group from the *Coeur d'Alene Syndicate Mining Company.*

Several shipments of uranium ore have been made from the remote *Coal Creek* claims in Custer County, Idaho's Stanley Basin primitive area recently. The claims, owned by Bill Brooks and Melvin Peterson of Hailey, are being developed by *Phillips Petroleum Company.* Ore bodies indicated by drilling are being prepared for open-pit mining. Phillips has also leased nine claims from Brooks and Peterson on upper Hardin Creek about one mile east, which the firm is exploring. Also in the area, *Rare Metals Corporation of America* has leased two groups of claims—the *Lucky Strike* group from Brooks and Peterson, and *Pine Hen* group from Brooks, Peterson, and Kauffman. *Sidney Mining Company* has leased the *Short Creek* group from Brooks, Peterson, and Stefanick. Both companies are working there now.

The *Bunker Hill Company* has developed a small ore shoot of good grade lead ore in the northwest sector of its property near Kellogg, Shoshone County, Idaho. The "blind" vein structure was encountered while crosscutting on the 1,300-foot level to explore the adjoining *Silver Bowl* property under a profit-sharing agreement. Mine, smelter, and zinc plant production have been reduced one-third this year through a series of curtailments that cut the rayroll from 3,000 to 2,200. Production currently is about in line with current ore receipts and metal sales.

Lucky Friday Silver-Lead Mines Company is producing about 175 tons of high-grade lead-silver ore daily from its property east of Mullan, Shoshone County, Idaho. The ore zone has been opened for about 700 feet on the 2600 level and 140 feet on the new bottom 3050-foot level. The company has been stockpiling metallic lead at the East Helena, Montana smelter. C. E. Horning, Wallace, is president.

Crosscutting, raising, and diamond drilling are underway at *Jack Waite Mining Company's* lead-zinc mine at Duthie, Shoshone County, Idaho, under a new lease arrangement whereby *American Smelting and Refining Company* will spend at least $100,000 in exploration work in 27 months.

Stockholders will consider this month the merger of *Polaris Mining Company* into *Hecla Mining Company.* Polaris is now an affiliate, with Hecla holding 55.06 percent of the Polaris stock. The proposal provides that one share of Hecla stock will be issued for every six shares of Polaris. It is considered a desirable move by Hecla because it would eliminate inter-company management and accounting problems, resulting in a single company with the necessary working capital to meet the increased expenses of exploration and mining.

The *Apache* silver and lead crushing mill six miles west of Hailey, Idaho was destroyed by a forest fire early last month. Damage was estimated at $250,000. The mill had recently been purchased by Howard Johnson and modernized.

Development work at the *Sunshine* mine, Shoshone County, Idaho, recently has disclosed more silver ore than for several years past. The ore was opened in the "09 vein on the 3,400-, 3,850-, and 4,000-foot levels, in the "08" vein on the 3,100-foot level, and in the footwall of the Chester vein on the 3,700 level where a short but extremely high-grade ore shoot was developed. Mine production for the first half of 1958 totaled 114,383 tons.

American Smelting and Refining Company is undertaking development of a new 4,000-foot level in the *Galena* mine west of Wallace, Idaho to reach the large silver vein. Sinking operations were temporarily suspended when the inclined winze from the 3,400-foot level reached 4,000 feet and a short crosscut was driven to the vein. An east drift advanced about 70 feet has exposed strong vein structure with good mineralization. In the lead zone south of the main shaft, the extensive diamond drilling program is still continuing. Asarco operates the mine for *Callahan Mining Corporation* under a long-term lease agreement. *Day Mines Inc.* holds a 25 percent interest.

The *Copper Camp Corporation* of Idaho is moving a 25-ton pilot mill and other mining equipment to company property near Yellow Pine, Idaho. Reportedly the firm plans to mine and mill gold and copper deposits at Big Creek.

The *Hope Mining Company, Inc.* of Ketchum, Idaho has been incorporated by Edwin C. Johnson, Vera Johnson, and Royce Russell, all of Redwood Falls, Minnesota.

The Idaho State Land Board has approved mineral leases for: Ray Paulsen of Lewiston, placer mining, 80 acres in Idaho county; F. H. Deatle Company of Lewiston for river-bed gravel in Clearwater River at Kamiah; Arnold Erickson of Lewiston for quartz, 86 acres in Clearwater County; W. S. Maylor of Kooskia, 160 acres for quartz and 40 acres for placer mining, both in Boise County; and Donald Scott of Melba, 320 acres for quartz in Owyhee County.

Recently incorporated in Idaho were the following firms: *Mason-Dixon Inc.* at Moscow by Lloyd G. Martinson, Patton A. Ross, and E. B. Newsome, all of Moscow; *Shasta Mining Corporation* of Weiser; and *Rock Creek Silver-Lead Company* of Wallace by Clarence D. Nelson, For-

Underground Mining Starts in Mt. Spokane Area

Bear Creek Uranium Company of Rhame, North Dakota, has undertaken the first underground mining operation in the Mount Spokane uranium district, Spokane County, Washington. The company believes this method will recover higher grade autunite than can be obtained by open pitting. A 7- by 9-foot shaft has been sunk to the ore zone, 83 to 97 feet beneath the surface. Drifting has been undertaken northerly and southerly in the ore body outlined by drilling. Oscar Herem, mine supervisor, is shown above operating a portable hoist in front of the mine shaft. The altered, fractured granite host rock is drilled, blasted, and mucked by hand. Emery & Pederson of Spokane are the contractors. Robert Swanke is president of the company.

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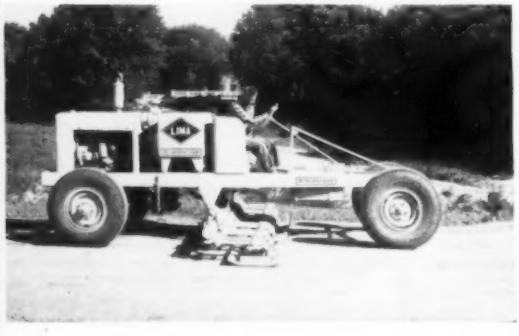

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MONTANA

The *P.K.F.M. & B. Company* and *United Idaho Mining Company* are activating the *Old Major Budd* mine of the *Rampart Mining Company* near the top of the Continental Divide east of Butte, Montana. They have reopened and retimbered an old drift into a shaft. Part of the shaft has been dewatered and the company expects to produce ore shortly.

Ben Walkup of Philipsburg, Montana is working the *Sunset* placer mine near Maxville, Montana. The deposit is located in a gulch which was only partially worked by old-timers. Water has been brought to the property and a dragline is used to strip the overburden and dig the gravel. The pay gravel is washed through sluices.

The five-year geological and minerals exploration program being sponsored by the *Great Northern Railway* and *Pacific Power & Light Company*, in cooperation with the *Montana Bureau of Mines and Geology*, has been started in the Troy-Libby area of Montana. A mapping crew under the direction of Willis M. Johns, bureau geologist in charge of the project field station, is working in the Yaak River quadrangle north of Libby. Ultimately, the project will complete a geological reconnaissance of about 6,800 square miles of northwestern Montana.

Exploration of the *Lucky Joe* uranium prospect on the West Fork of the Bitterroot River, Ravalli County, Montana, has been resumed by *National Uranium Corporation* and *Hypotheck Mining & Milling Company*, both of Wallace, Idaho. Drifting and raising are called for.

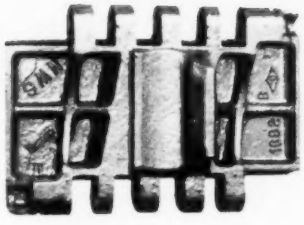
The *Norwich* manganese mine which was recently shut down because of the government's curtailment of its manganese purchase program, produced about 57,000 long dry tons of manganese carbonate ore averaging 21 percent Mn during its six years of operation. The mine was managed by I. G. Irving and R. H. Nelson for the first four years, and then by *Umont Mining Inc.* under lease and bond. The mine was developed to a depth of 400 feet, with Umont operating on the bottom levels.

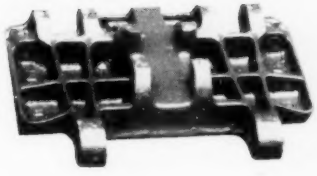
The old *Montana Standard* property on Prospect Creek, Sanders County, Montana has been leased by Clifford L. Fausett of Wallace, Idaho. Albert McCorkle will be his partner. The Montana Standard company rehabilitated the early-day producer several years ago and shipped some lead-silver-zinc ore to the Golconda concentrator near Wallace, Idaho.

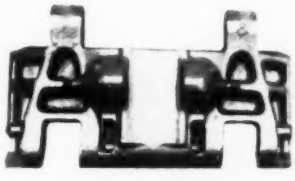
OREGON

Harvey Aluminum Company has started production at its new $65,000,000 aluminum reduction plant at The Dalles, Oregon. Capacity of the new smelter is more than 100,000,000 pounds of aluminum annually.

Columbia MANGANESE STEEL CRAWLER SHOVEL PADS







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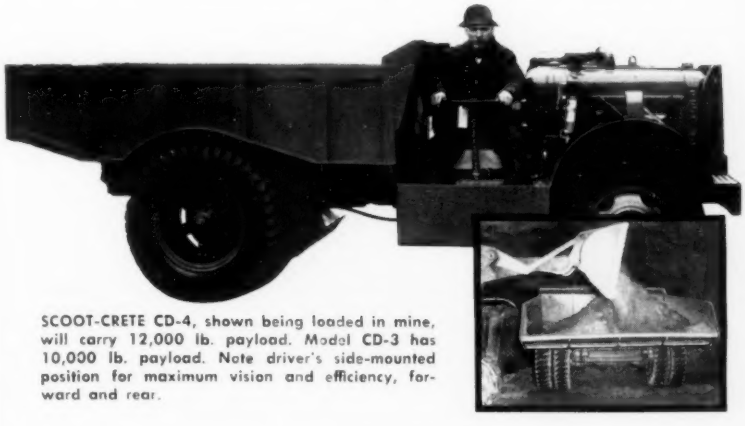

SCOOT-CRETE CD-4, shown being loaded in mine, will carry 12,000 lb. payload. Model CD-3 has 10,000 lb. payload. Note driver's side-mounted position for maximum vision and efficiency, forward and rear.

On the Western Slope, on the Colorado Plateau, SCOOT-CRETE does the job. No rails needed, no ties, no cars, no independent power source. Diesel-powered for operation inside the mine, SCOOT-CRETE carriers are rugged for around-the-clock service, carry up to 12,000 lbs. at speeds to 15 mph, climb grades up to 18%.

Units available from 3,000 to 12,000 lb. capacity. Write for specifications and literature. See your Dealer.

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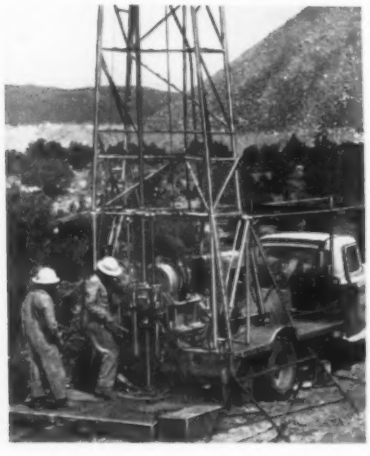

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Oregon Metallurgical Corporation of Albany, Oregon has appointed three firms as distributors of its titanium zirconium, and other reactive metals. These firms are *Electric Steel Foundry Company* of Portland, Oregon; the *Ladish Company* of Cudahy, Wisconsin; and *Hi-Vac Metals Division* of *Symington-Wayne Corporation* of Depew, New York. By the combined sales organizations of these three firms, OREMET is provided with a nation-wide outlet for its products.

U. S. Bureau of Mines' research on ways of producing high-purity boron and determining its characteristics will be accelerated during the 1959 fiscal year in efforts to provide more technical information to aid commercial production and increase utilization of this important and versatile element. During the current fiscal year, which began July 1, Bureau metallurgists at the *Northwest Electrodevelopment Experiment Station*, Albany, Oregon, will continue their studies of methods of producing high-purity boron by reducing boron halides with an active metal, by fused salt electrolysis, and by electrolysis from organic baths. Research on purification and processing of the experimental products will involve such methods as vacuum sintering, arc melting in inert atmospheres, electron bombardment, and controlled crystal growth. Physical, chemical, and electrical properties will be determined for all significant samples.

WASHINGTON

Mudhole Exploration Corporation has shipped 400 tons of autunite from its Mount Spokane district property, northern Spokane County, Washington, to *Dawn Mining Company's* uranium processing plant at Ford. The ore was mined by trenching. David Berry is company geologist in charge. Ralph Umbreit of Spokane is president.

Skookum Uranium, Inc. is opening a uranium deposit (autunite) at its holdings in the Skookum Lake area north of Newport, Pend Oreille County, Washington. The firm has leased 320 acres from *Carney Pole Company* on Ojibway Ridge, bringing its holdings to 1,000 acres. T. A. Tester, Spokane, is president.

Spokane Mountain Uranium Company has found uranium mineralization in 17 of 21 holes drilled to depths of 11 to 114 feet in northern Spokane County, Washington's Mount Spokane District. Ore is being stockpiled from open-cut work. Another drilling program is planned near radioactive springs. Al R. Perri, Lewiston, Idaho, is company president.

Pacific Northwest Alloys, Inc. recently resumed limited production of low-carbon ferrochrome at its Mead, Washington plant just north of Spokane. About 175 employees were recalled following a month's shutdown. The plant employs some 450 during periods of normal demand for its product by the steel industry.

Floyd Hulbert, Ray Putnam, Kenneth Grossarth, and Earl Chilcott have recorded 21 mining claims southwest of Tiger; Dennis O'Brien, nine claims near Jared, and L. B. Laird four claims west of Blueslide, all in Pend Oreille County, Washington.

Dawn Mining Company, operator of a uranium processing plant at Ford, Washington, is moving from 1,000 to 1,100 tons of ore daily, five days a week, to the mill from its *Midnite* and *Boyd* open-pit mines in the Spokane Indian Reservation (southwestern Stevens County). The mining is done under contract by *Isbell Construction Company*, with about 20 men; the hauling by *Vic-Ore, Inc.*, Spokane, with about the same number of men. J. J. Crowhurst is manager of the *Newmont Mining Corporation* subsidiary.

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Ungava Iron To Construct Greenland Transit Harbor

The Danish government has reportedly accepted a proposal made by Ungava Iron Ores of Canada to construct a transit harbor near Godthib, Greenland, which will handle iron shipments from the company's operations on Ungava Bay, Canada. According to Ungava's plan, iron shipments will be transported from the Bay during the relatively short shipping season, and stockpiled at the harbor in Greenland for exporting to United States and European markets throughout the year.

Ungava Iron Ores, owned 50-50 by German interests and Cyrus S. Eaton interests, was formed last year to operate concessions totaling more than 700 square miles on both sides of Payne Bay. Known reserves are set at 500,000,000 tons of ore; indicated reserves nearly double this figure. The ore is magnetite-hematite, assaying 35 percent iron.

Initial mining operations will be on the Castle Mountain zone, which is believed to contain approximately 200,000,000 tons of ore that can be obtained by open pitting, with a minimum of stripping required.

Construction plans call for a 25-mile railroad, crushing equipment, concentrating plant, pelletizing plant, pellet storage facilities, power plant, and a complete townsite, as well as the dock installation. The concentrating plant will be built in units of 500,000 tons of pellets, the first of which is scheduled for production by 1963. More units are expected to be completed as markets develop, and an ultimate of 5,000,000 tons of pellets annually is anticipated.

Ungava Irons Ores is owned by two other Canadian corporations: Champlain Mining Corporation which represents Eaton interests, and Ferrum Investments Ltd., which represents the German firms of Freidrich Krupp of Essen, Hoesch Bergwerk of Dortmund, Mannesmann Roehrenwerke of Dusseldorf, and Huettenwerk Oberhauser of Oberhausen. Exploration and development costs have been shared equally by the two interests for the past two years.

Red Devil Mine Still Major Mercury Producer

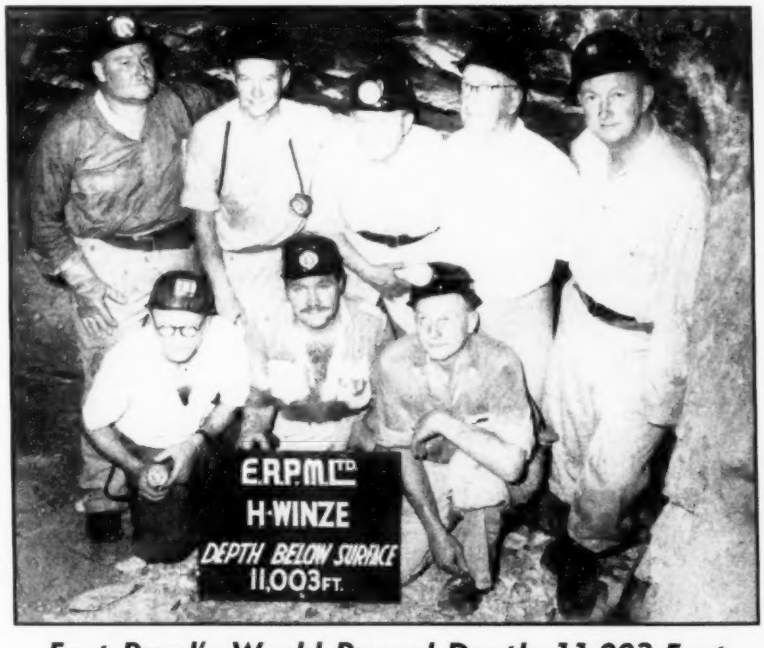
The Red Devil mine in Alaska continues to be one of North America's leading producers of mercury, according to a recent report from DeCoursey-Brewis Minerals Ltd. of Toronto, Canada. Since the company began production from the mine in March 1956, to July 31, 1958, 10,014 flasks of mercury have been produced. Of this amount, 9,964 flasks have been sold for a total of $2,323,397.50.

General overhaul of furnace and replacement of condenser tubes during June and July caused a slight drop in production. Work has been completed and operations have now returned to normal. Addition of new equipment in the furnacing plant is expected to improve recovery and reduce health hazards.

In current development of the Dolly veins, a raise from the third level recently intersected the Dolly No. 5 vein, 140 feet below the surface. High-grade cinnabar, 2 feet wide, was reported in the raise. Length of the oreshoot, although not yet determined, is well over 30 feet.

FEDERATION OF RHODESIA & NYASALAND—*Kansanshi Copper Mining Company Ltd.* plans to sink another shaft at its *Kansanshi* mine in Northern Rhodesia to facilitate pumping the mine out. It was completely flooded in the underground workings last year, and subsequently closed. Production costs at that time were about 21.25¢ per long ton of copper and it is anticipated that this figure can be reduced appreciably. *Anglo American Corporation of South Africa Ltd.* and *Rhodesia-Katanga Company* have an interest in the firm.

ANGOLA—*Pechiney*, the French aluminum producer, has reached an agreement with *Aluminio Portugues (Angola) S.A.R.L.* to build a 50,000-ton aluminum plant in Angola. Initially, the plant would produce 25,000 tons a year. A hydroelectric power plant at Cambambe on the Middle Cuanza River would supply an estimated 920,000,000 kilowatt hours a year to the plant when it is operating at full capacity. (The hydro plant's capacity is to be 1,420,000,000 kilowatt hours.) Pechiney is to act as consulting engineer and will have a major capital participation. Other French firms are to supply the necessary equipment for which medium term credits would be granted.



East Rand's World Record Depth—11,003 Feet

It's getting to be a habit in the gold mines of South Africa. South Africans have set a new world's mining record! This time it's the deepest mine in the world—a vertical depth of 11,003 feet below the surface at East Rand Proprietary Mines, Limited at Boksburg, Transvaal. The company reached a depth of 10,000 feet in November 1955 and has continued sinking since that date. On the dip of the reef the distance from the outcrop to the deepest workings is over 3.5 miles. To reach the deepest point, it takes more than an hour from the surface as you are lowered down a number of shafts and winzes. It gets hotter, too, during this trip as the rock temperature rises from 65 to 123° F. It took East Rand almost exactly 50 years to reach this depth, while mining and milling 103,000,000 tons of ore (to the end of 1957 from first production in July 1938) and recovering 25,000,000 ounces of gold. Pictured above at the record depth from left to right in front row are: C. Regan, acting chief engineer, East Rand; A. de M. Malan, underground manager central section; and J. O. Kempe, sectional manager central section. Back row: R. J. Rouillard, assistant general manager; F. G. Hill, technical manager and consulting engineer, Rand Mines Ltd.; J. J. Dolan, consulting mechanical and electrical engineer, Rand Mines; D. MacNiven, general manager, East Rand Mines; and A. R. C. Fowler, consulting engineer, Rand Mines. This record depth was celebrated in Boksburg on 8 August with P. H. Anderson, chairman of the board of directors, outlining the features of the operation which made possible the advance to the depth of 11,000 feet and would, if, as looked probable, the grade held, take these still deeper to at least 12,000 feet below surface. The main factors in the achievement are: long-wall stoping, which has reduced the hazard of pressure bursts to negligible proportions, de-stressing operations prior to the start of the working shift; and better ventilation combined with more efficient control and with expanded refrigeration or cooling of the air, as well as delivering the air to the working places at a high velocity. The importance of the ultra-deep operations for East Rand Proprietary Mines Ltd., for Boksburg, and the country's economy and finances, are assessed in the estimates that each 1,000 feet on the reef-dip adds up to 10,000,000 tons of ore to the mine's potential and up to 2,500,000 ounces to the yield, which would have a value of more than £30,000,000.

"Not merely to sell; but to serve . . . not only to make good steel products; but to make them still better . . . not only to fulfill today's requirements; but to anticipate tomorrow's—these are the principles that constantly guide CF&I."

G. F. Franz
President

Grinding Mill Bulletin #3

This series of ads on grinding ball rationing of the makeup charge is being presented by CF&I in keeping with our policy "*Not merely to sell; but to serve*". It is our hope that the series will shed some new light on the subject by expressing established principles in practical terms, and that grinding mill operators who are interested in increasing the efficiency and production capacity of their ball mills will find this information of value.

The One-Size Ball Makeup Charge In An Operating Mill

Previous articles in this series have pointed out that determining the optimum size assortment of grinding balls that should be added as a makeup charge is a practical means of improving mill operation; and that the best makeup charge of one-size balls should be established before an attempt is made to work out a rationed makeup charge.

It is better to use oversize rather than undersize balls in the makeup charge. The reason for this is that there is always the possibility of encountering ores that are more difficult to grind. The larger ball would reduce this difficult-to-grind ore, whereas a smaller ball would not. This leaning towards oversize balls is recommended even though they will give fewer contacts and less attrition grinding than a smaller ball.

Indications of Incorrect Ball Size

In a closed circuit mill, a too-small ball size will fail to reduce larger feed particles, and too much tramp oversize will be circulated. Thus, the circuit will become choked, and you will find it necessary to reduce mill feed. With a too-large ball size, coarse particles will be reduced in size, but excessive amounts will need further reduction and excessive slimes may be produced from the impact of large balls. The partially reduced ore particles will overload the classifier, making a reduction in mill feed necessary. Thus both too-small or too-large balls will lower mill production.

In an open circuit mill, balls that are too large do not produce the fineness of grind, or liberation size, required, and they may produce too many slimes. Grinding balls that are too small, on the other hand, permit tramp oversize to enter the next process.

Price May Be Deciding Factor

The 3″ diameter steel ball is commonly the lowest-priced ball available whereas small size grinding balls are priced higher. The 3″ balls are used most frequently in beneficiation mills and are usually obtainable on an immediate-shipment basis. However, where $3\frac{1}{2}$″ and 3″ diameter balls give similar results in grinding a particular ore, the $3\frac{1}{2}$″ ball may be chosen because of the insurance it provides against the production of tramp oversize should more difficult-to-grind feed ore be encountered later. Nevertheless, the lower price of the 3″ ball may be the deciding factor.

Radical Changes are Undesirable

As in other experimental work in an operating circuit, it is good practice not to make too radical a change in the ball size used. Where it is indicated that 4″ diameter balls would be more satisfactory than the 3″ balls in use, it would be wiser to test $3\frac{1}{2}$″ balls first, then check results to prove you are going in the right direction. Or, if it is considered that $2\frac{1}{2}$″ balls will improve results as compared with the use of 3″ balls, it may be better to substitute $2\frac{1}{2}$″ diameter balls for one-quarter or one-half the charge and then check for improvement before using $2\frac{1}{2}$″ balls as 100% of the makeup charge.

Whatever the optimum size grinding ball you need for the makeup charge in your operating mill, you'll find it available from CF&I . . . in diameters from $\frac{3}{4}$″ to 5″. CF&I grinding balls are forged from special analysis steel and are carefully inspected—throughout production and again immediately prior to shipment—to ensure that they are free of surface pits, circumferential ridges or other surface unevenness. The CF&I representative nearest you will gladly give you complete details.

In the next article in this series, we will discuss general methods of rationing, and the specific steps to be taken in working out a ball ration.

For a reprint of the article on which this ad is based, please write on your company letterhead to: Mining Supply Department, The Colorado Fuel and Iron Corporation, P.O. Box 1920, Denver, Colo.

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6083

TANGANYIKA—The Tanganyika government and *De Beers Consolidated Mines Ltd.* have each secured a 50 percent interest in *Williamson Diamonds Ltd.*, owners of the high-grade diamond mine at Mwadui. Purchase price is £4,140,000, plus death duties, or a gross of £5,600,000. The mine has been given an output allotment of 10 percent of the world production from *Diamond Corporation*. This has not been attained in practice; the mine has been producing what would amount to about 4 percent of the Diamond Corporation's output.

FRENCH WEST AFRICA—Financing arrangements have been completed for the development of the bauxite deposits in French Guinea. *FRIA pour la Production de l'Alumine* was formed more than a year ago to build an alumina plant and to mine bauxite deposits near Fria, about 96 miles from the coast. The plant will have an initial capacity of 480,000 tons of alumina annually, and production is scheduled to start in 1960. Total cost of the project will be provided as follows: *Olin Mathieson Chemical Corporation* $21,000,000; *Pechiney* and *Ugine* $10,000,000; *British Aluminium Ltd.* $4,000,000; and *Aluminium Industrie-Aktiengesellschaft* $4,000,000; $96,000,000 will come from institutions and other lenders, making a total of $135,000,000 for the project.

UNION OF SOUTH AFRICA—*Afrikander Lease Ltd.*, which has been opening the new Rietkuil Section, has applied for an increased uranium output quota. Pending a reply, the company has suspended development in that section. *Klerksdorp Consolidated Goldfields Ltd.* recently was advised by the Minister of Mines that it would not be possible to admit Klerksdorp as a producer of uranium oxide in the present contract with the *Combined Development Agency* because of the recent ceiling placed on supplies under the contracts. The Minister added that the *South African Atomic Energy Board* is exploring the possibility of finding additional markets for uranium in countries other than those represented by the Agency but could not state when it would be possible to admit the company to the uranium production program. Klerksdorp, therefore, is placing its property on a care and maintenance basis. While this does not sound optimistic for Afrikander's application, the fact that Afrikander is already a designated uranium producer may add weight to its request.

NIGERIA—During the current tin restrictions, *Gold & Base Metal Mines of Nigeria Ltd.* has decided to concentrate the company's main productive effort on the Jemas areas, partly because of possibilities of finding occurrences of low-grade tantalite (in association with tin) in economical quantities, but also because the company's future lies in this area. For some years, the company has been steadily building up a compact block of leases in this part covering not only alluvial deposits but also extensive pegmatite formations. Preliminary geological information has indicated that further mineralization occurs in that vicinity and, accordingly, additional applications have been filed for the grant of Special Exclusive Prospecting Licenses covering approximately 100 square miles immediately adjoining the north and west boundaries of existing leases. Permission to prospect this area over a period of one year has been received and work is proceeding despite tin restrictions, because otherwise the license area would have to be surrendered and would become available to others.

FEDERATION OF RHODESIA & NYASALAND—Research into the sulphide and oxide ores of *Kansanshi Copper Mining Company Ltd.* has devised a new process whereby a 90 percent copper recovery can be obtained. Commercial rights to the process are expected to be held by Kansanshi, although the research work was handled by the research and development division of *Rhoanglo Mines Services*, a subsidiary of *Anglo American Corporation of South Africa* who are acting as consulting engineers. It is believed that the process could be of value to other mines having substantial tonnages of copper ores not at present amenable to normal treatment methods.

GHANA—At the end of the present diamond sales contract with the *De Beers Central Selling Organization*, which has another two years to run, Ghana's diamond exports will be handled on the independent basis which has already been established to market the output of local miners. On the present contract, about 1,000,000 carats may be involved per year, of which about 78 percent is represented by cheaper industrial qualities.

UNION OF SOUTH AFRICA—*Associated Manganese Mines of South Africa*

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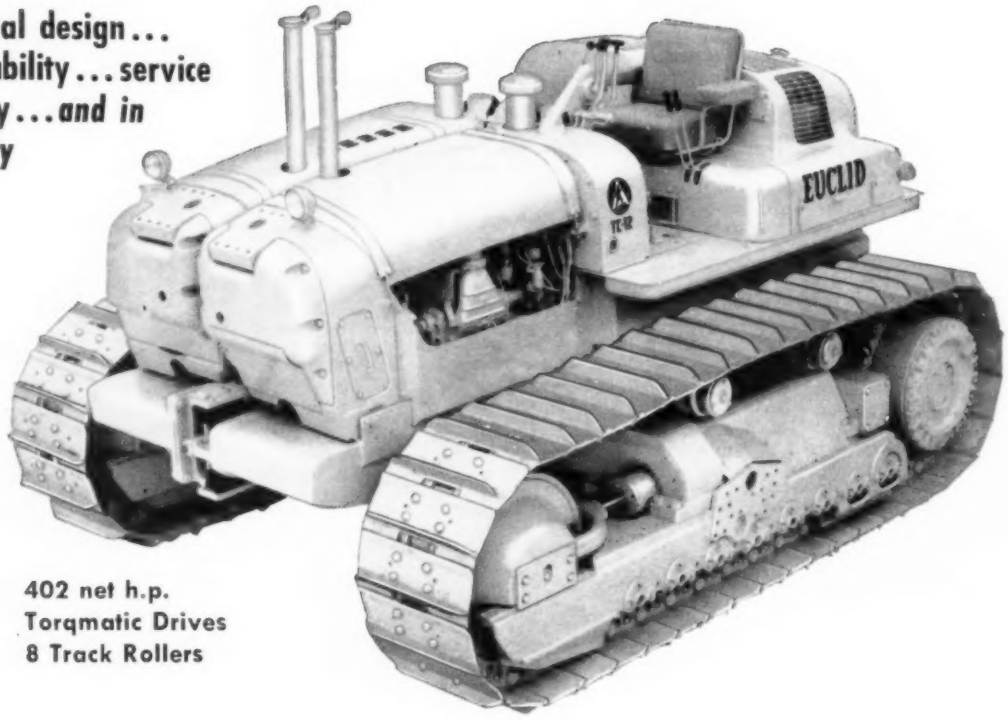

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With independent track drives, there's no dead track drag when turning—maneuverability of the big TC-12 with its full power shift saves seconds on every cycle whether push loading scrapers, dozing or pulling big equipment. With unitized assembly, good design of component location and equipment mountings, this "Euc" provides easy accessibility for service and maintenance.

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Ltd. expects its associated *Feralloys Ltd.* to start ferromanganese production toward the end of 1959 at its Natal installation. The former will supply ore from new manganese operations now being developed so exports will not be affected. Shipments by rail for export amounted to 254,941 tons in 1957, and should be increased in 1958, despite continued restrictions of rail truckage available. The Associated Manganese company, which holds leases, mineral rights, and freehold over 137,000 acres in the Kuruman/Hay areas, has recently acquired a new lease over 4,629 acres in the same area.

AUSTRALIA—The Commonwealth Government has decided to stockpile beryl ore because of anticipated demand for beryllium in nuclear fuels. There has been a restriction on the export of beryl ores and concentrates since 1947, with export under license permitted only to Great Britain. These ores and concentrates will now be purchased by the Federal government at current prices. South Australia has been a small producer of beryl ore from the Clary district for a number of years.

REPUBLIC OF THE PHILIPPINES—The Philippine government has approved a contract which authorizes *Consolidated Mines Inc.* to sell about 130,000 long tons of refractory chrome ore to the United States Department of Agriculture in exchange for 30,000 metric tons of California pearl milled rice. The firm is one of the principal producers of refractory chrome ore in the Philippines and has been hard hit by recent cancellations of orders from U.S. consumers. The barter agreement will help to prevent a shutdown of the firm's mines. *Acoje Mining Company*, the country's largest chrome producer, is reported to be seeking a similar arrangement for disposal of its present output.

FIJI ISLANDS—*Emperor Gold Mines Ltd.* at Vatkuola showed better production figures in the year ended June 30, 1958. 180,888 tons were treated for a recovery of 74,931 ounces of gold. The Fijian government has granted the company a subsidy for three years to June 1961 of £2 Fijian per ounce of gold up to a maximum payment of £150,000 per year. This will assist the company in developing the lower levels of the mine.

REPUBLIC OF THE PHILIPPINES—The *Balabac Mining Company* and *Benguet Consolidated Inc.* have signed a contract which provides for exploration of Balabac's extensive mineral properties in Palawan Province by Benguet. The contract covers a period of 18 months, and was signed after preliminary exploration by geologists of both companies. Tests made several years ago on outcrops of an iron ore deposit held by Balabac showed an average of 55 percent iron.

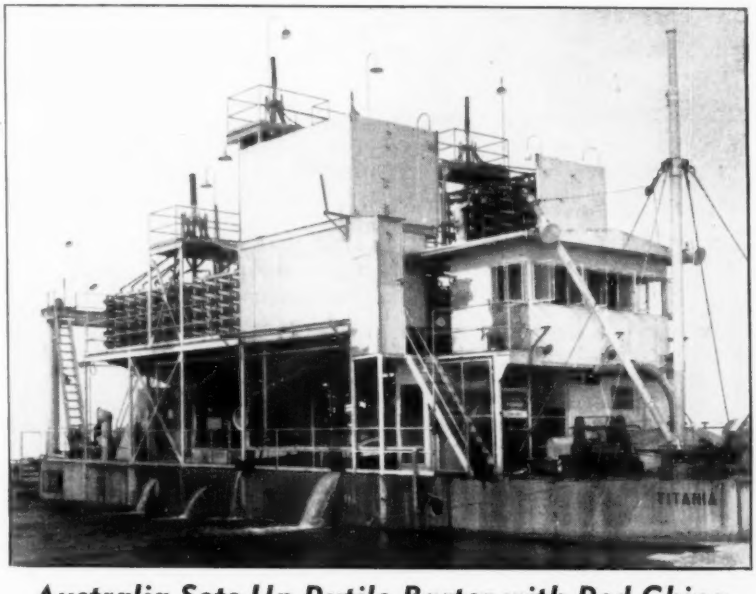
WESTERN AUSTRALIA—*Great Boulder Pty. Ltd.* is spending £250,000 on conversion of its hoist operation from steam to electricity and on power house extensions. Since 1950 the company has spent £400,000 on power plant and electrifications. Great Boulder is treating about 470,000 tons of ore per year for a recovery of 112,000 ounces of gold. *North Kalgurli Ltd.* is improving its treatment plant and plans to deepen the main shaft to 2,150 feet at a cost of £130,000. The present shaft bottom is at about 1,800 feet. By South African standards, these Western Australian mines are small, but their treatment practices are efficient and of great importance to the state and to Australia's economy generally.

QUEENSLAND—*Rio Tinto Company Ltd.* reports that reserves of ore at *Mary Kathleen* exceed requirements to complete the initial contract with the *United Kingdom Atomic Energy Authority*. (Rio Tinto owns the major interest in *Mary Kathleen Uranium Ltd.*) The ore body at Mary Kathleen is larger than originally estimated. The contract with the Atomic Energy Authority continues for eight or nine years. Production of uranium oxide has started without trouble.

TASMANIA—Iron ore deposits at Savage River may contain more than 100,000,000 tons of commercial grade ore. The Tasmanian Department of Mines and the *Rio Tinto* group are associated in testing the area. A second drill hole recently disclosed a continuance of the deposit over a width of 300 feet and to a depth of 500 feet. This hole is 600 feet north of the first where ore is 200 feet wide over a similar depth. It is estimated that 8,500,000 tons of ore are proved by the drilling already completed and, as the deposit is more than two miles long, it is considered that more than 100,000,000 tons will finally be disclosed. Assays of drill cores average 46 percent iron and this can be stepped up to 65 percent by magnetic concentration with 99 percent recovery. A small quantity of titanium in the ore is considered insufficient to prevent use of the ore for commercial iron and steel making. There are no other significant impurities.

TURKEY—Two United States firms, *Twentieth Century Fuels Inc.* and *Mid-East Oil and Mining Company*, are reported to have negotiated with the *Etibank*, controller of Turkey's state-held natural resources, over development and production of chromite and manganese deposits. A co-partnership is to be formed with the Etibank for this undertaking.

INDIA—India and Japan have agreed upon a contract for shipping of 1,600,000 tons Indian iron ore to Japan over a one-year period. Japan will import



Australia Sets Up Rutile Barter with Red China

Australia's rutile industry is experiencing a small revival because of the recent barter agreement made with Red China. An exchange of 3,500 tons was provided for in the first agreement, and a similar exchange of tonnage is to be made in the second barter. Zircon Rutile Ltd. at Byron Bay and Crescent Rutile N.L. at Kilcare were the two principal contributing firms. Crescent has resumed beach mining; its plan. has been on a standby basis. Most other producers in the area remain on reduced output if not altogether completely shutdown. Titanium and Zirconium Industries Pty. Ltd., whose suction dredge is shown above, has been one of the largest producers. The "Titania" worked a swamp deposit on North Stradbroke Island off the coast of Queensland. (Humphreys spirals can be seen on its deck.) Rutile cutbacks bring a subsequent cut in zircon which is obtained as a byproduct of rutile in those cases where it pays to clean the zircon-bearing fraction. Costs of operation are normally all charged against rutile and only the actual cost of cleaning zircon is logged against production of that mineral. It would be a strange situation if resulting prices for zircon during 1959 and 1960 were such as to make zircon attractive, but with producers being unable to take advantage of this because of low rutile prices.

1,400,000 tons of 65 percent ore and 200,000 tons of higher and lower grade ore. India will receive Rupees 9½ crore for the total order.

JAPAN—*Nippon Light Metal Company's* smelter at Niigata which was dismantled after 1945 is now being reopened and rebuilt. Its capacity will be 20,000 tons annually. In 1956, NKK produced 72 percent of Japan's total ingot production of 73,000 tons. *Aluminium Ltd.* holds half of the capital stock in NKK. In 1953 and 1956, NKK plants supplied 55,000 tons of alumina to Aluminium's smelter at Kitimat, British Columbia, Canada.

MALAYA—The *Perak State Chinese Mining Association* has asked the government of the Federation to help the small-scale independent tin miners to face the crippling restrictions imposed by the *International Tin Council* in an effort to bolster the price of tin. Three proposals have been submitted: the free sale of tin quotas; a basic quota of 50 piculs per month to each gravel pump mine; the abolition of the miners' contribution to the tin buffer stock. The Association points out that miners need to produce a minimum of 50 piculs monthly to keep operating; yet, the present restriction for more than half the 360 Chinese-owned tin mines in Perak was for a quota of less than 25 piculs monthly.

INDIA—Poland may assist in the development of India's copper mines at Khetari in Rajasthan. A team of Polish experts is expected to meet with government representatives to discuss technical and financial arrangements for such a project. According to preliminary investigations by the Union Minister of Steel, Mines and Fuels, it should be possible to mine 100 tons of ore per day from the *Khetari* mines.

MALAYA—Completion of the road relocation at *Batu Karang* has released for *Idris Hydraulic Tin Ltd.* a considerable volume of medium grade ground for immediate treatment. This area, plus the introduction of power supply formerly used at the Kranji Section, together with additional plant, has resulted in an increased rate of output far in excess of the low-grade quota in force under the Tin Control Regulations. An appeal has been made and the original allotment of 66.5 tons has been increased to 119 tons, but this is still substantially below the company's productive capacity. However, the position has been helped by an arrangement with the purchasers of the Kranji section, *Societe des Etains de Kinta*, which provides that they would make available to Idris under a grouping system a further allotment of 121 tons.

INDIA—A 35,000-ton per year ferromanganese plant has gone into production at Joda in Keonjhar district of Orissa state. The plant will meet the requirements of *Tata Iron and Steel Company* plant. Another plant is being set up in Rayagada in Koraput district of Orissa state.

MALAYA—*Pucket Tin Dredging Ltd.'s* properties have a very limited life, and so a provisional agreement has been reached with *Tronoh Mines Ltd.* whereby Pucket will sell to Tronoh for £107,000 its dredge and property, all stores, and buildings, as well as the quota under Tin Control Regulations.

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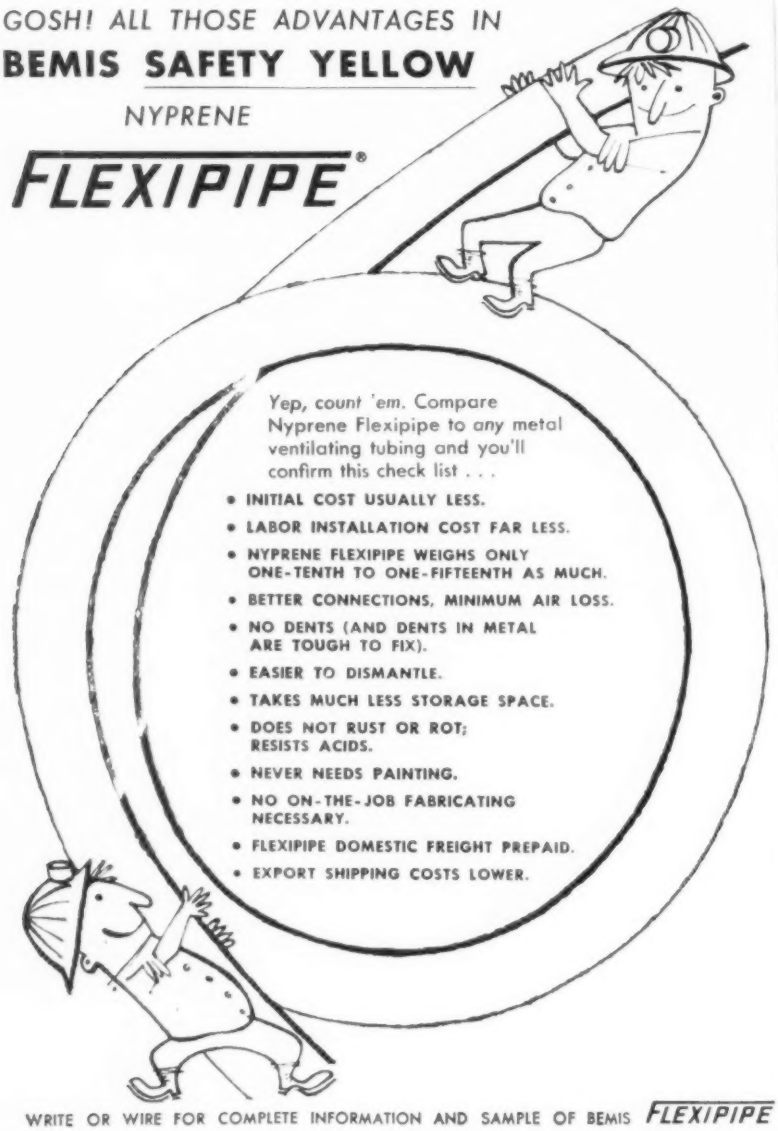

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LUXEMBOURG—A new company, *Continental Titanium Metals Corporation*, has been established by *Titanium Metals Corporation of America* and *Deutsche Edelstahlwerke* (DEW) of West Germany to produce and market titanium in Europe. The new firm will have headquarters in Luxembourg, while production will come from DEW's plant at Krefeld, West Germany. As sales increase, the company will acquire its own production facilities.

UNITED KINGDOM—*South Crofty Ltd.* proposes to offer £83,000 worth of 6½ percent convertible debentures to shareholders in order to finance deepening of the new *Cook's Kitchen* shaft, as well as expansion and modernization of the mill. Trading losses have been incurred during the first five months of 1958, and it is hoped that with the aid of fresh capital, profitable operations can be resumed.

WEST GERMANY—Metal production figures released by the *West German Statistical Office* for the month of June 1958 include the following: aluminum, 12,481 metric tons; electrolytic copper, 15,610 metric tons; refined copper, 5,198 metric tons; primary lead, 13,784 metric

Dumping uranium ore at reduction mill in Moab, Utah. The bluff in the background indicates the terrain encountered by G. P. Decker's Macks, which are . . .

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tons; crude zinc, 14,209 metric tons; and pure tin, 102 metric tons.

UNITED KINGDOM—Information describing gypsum and anhydrite is now available in a publication entitled "Gypsum & Anhydrite," prepared by the late A. W. Groves. It can be obtained from the *Overseas Geological Surveys*, Mineral Resources Division, Commonwealth Institute Building, London S.W. 7, England. The price is $1.06, plus postage.

RUSSIA—Six-month production figures just released by the Soviet Union, together with the 12-month goal for 1958, are as follows: pig iron, 19,300,000 metric tons produced toward an annual goal of 39,100,000 metric tons; raw steel, 27,000,000 metric tons toward 53,600,000 metric tons; and rolled steel, 21,300,000 metric tons produced toward 41,700,000 metric tons scheduled for 1958. It was reported that 1957 production of pig iron, ingot steel, and finished steel fell short of the goal set for the year.

UNITED KINGDOM—The Board of Trade has established a three-month quota of 750 tons of unwrought tin and tin alloy exported from the Soviet Union. Applications to import from other territories in the Sino-Soviet bloc will be considered individually and imports allowed within normal trade levels. Imports of Soviet tin at the first of 1958 totaled 3,452 tons, compared to 2,150 tons imported during all of 1957. British officials said the Netherlands had agreed to impose similar restrictions.

NORWAY—*A/S Aardal og Sunndal Verk* has concluded a new contract with *Aluminium Limited Producing Company* of Jamaica, subsidiary of *Aluminium Limited* of Canada, calling for delivery of approximately 4,400,000 short tons of alumina during the next 20 years. Earlier this year, Aardal contracted with Aluminium Ltd. for delivery of 1,720 tons (see MINING WORLD, June 1958, page 66). However, the company's production capacity is being expanded from 75,000 tons to 125,000 tons of primary aluminum annually, by 1961, and new arrangements for increased deliveries were necessary. Payment for the alumina will be made in aluminum ingots.

WEST GERMANY—*Phoenix-Rheinrohr A. G.* of Duesseldorf has just completed installation of a new Siemens-Martin furnace at its Mulheim plant, increasing capacity from 28,000 to 45,000 metric tons of crude steel monthly. The new furnace is completely automatic and heated entirely by oil. Phoenix-Rheinrohr operates seven plants on the Rhine and Rhur rivers, and average annual output totals 2,400,000 metric tons of crude steel.

ONTARIO—*Geco Mines Ltd.* plans to sink a 1,000-foot winze to continue development work to a depth of 2,250 feet at its copper-zinc-silver property in the Manitouwadge area. The winze will be sunk on the 1,250 level where exploration driving and diamond drilling have been going on. This additional development work is expected to take about 2½ years. Geco has been driving east on the 1,250 and also on the 1,050 level, and has been driving west on the 850 level.

BRITISH COLUMBIA—A contract for 20,000 feet of diamond drilling has been let by *New Hamil Silver-Lead Mines Ltd.* for investigation of its *Canford* prospect in the Merritt copper district. Robert D. MacAfee of *Robert D. MacAfee and Associates*, California consulting engineers, will confer with New Hamil's local consulting geologist, A. R. Allen, in laying out the drill pattern. The company is also conducting a magnetometer survey on its *Louis* group in the Highland Valley copper belt. These claims are of particular interest because they are close to a section of the *Jericho Mines* property currently being investigated by *Phelps Dodge Corporation of Canada*.

QUEBEC—*Conwest Exploration Company* has taken over the promising copper discovery made by *Kennco Explorations (Canada) Ltd.* in the Mattagami area of northwestern Quebec. A new company is to be formed, in which Kennco will hold a substantial interest. The mineralization was found in an area to the east of Bell River in Isle-Dieu township, about seven miles northeast of the *Mattagami Syndicate* property optioned to *Noranda* and its associates, and about 12 miles east of *New Hosco*. Conwest plans further exploratory work, including both geophysical surveying and diamond drilling.

ONTARIO—*Milliken Lake Uranium Mines Ltd.* is producing at full tonnage from its property in the Algoma district. Since the Milliken shafts were only completed in December 1957, and the mill started operation in April 1958, this tonnage build-up is considered something of of a record. During July 88,179 tons were treated, averaging 2,844 tons per day; in August output averaged 3,240 tons per day. The mill is achieving an average recovery of 93.25 percent. With development work gradually running ahead of production, the firm is reaching a position where selection of ore for grade control can be exercised. Milliken is under the management of *Rio Tinto*; it holds a contract for the sale of $94,525,000 worth of uranium oxide to *Eldorado Mining and Refining Ltd.*

QUEBEC—*Oglebay Norton Company* of Cleveland, Ohio has taken an option on an iron property in Montgolfier township of northwestern Quebec from *Atlin-Ruffner Mines Ltd.* Oglebay Norton is to spend $25,000 by December 1, 1959 to investigate the ground. The firm will also pay Atlin-Ruffner $6.00 per foot for any drill core used for concentration tests. If results are favorable, Oglebay Norton will then receive a production lease on a royalty basis of 25¢ per ton of iron concentrates produced. Oglebay will also pay $50,000 per year starting December 1, 1959, until a total of $300,000 is paid, less money paid for core used in testing. Then a minimum royalty will be paid to Atlin-Ruffner, gradually being increased to $50,000 per year for the length of the lease or until production is started. Atlin-Ruffner will also receive 5 percent of the gross value of sales of any other marketable minerals that may be found, or 20

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percent of the net profit, whichever is less. Oglebay will also have the right to purchase Atlin-Ruffner stock.

ONTARIO—New sponsors of *H. G. Young Mines* have assured additional funds ($500,000) and so a major explora- and development program is about to be undertaken in the Red Lake gold area. Immediate plans call for sinking of a 750-foot three-compartment, production shaft. Drifts will be driven on several levels to explore ore zones indicated by surface drilling. Participating in the project are: *Bronlan Reef Mines* 15 percent; *Campbell Red Lake Mines* 20 percent; *Moneta Porcupine Mines* 15 percent; *Hugh-Pam Porcupine Mines* 10 percent; *Mespi Mines* 20 percent; *O'Brien Gold Mines* 5 percent; *J. Bradley Streit and Company* 20 percent. Most of the property lies under the Balmer Lake; however, Campbell Red Lake has granted the company a long-term lease on a suitable shaft site on its ground close to the common boundary. The lease provides that Campbell may explore its own property from the Young workings.

SASKATCHEWAN—*Potash Company of America Ltd.* expects its new plant to be ready for operation next month, but does not expect the entire installation to reach rated capacity before early spring of 1959. Some production will be forthcoming by the end of this year, however. The shaft has cut the main ore bed at a depth of over 3,300 feet and was bottomed at about 100 feet below. Station cutting is going on.

BRITISH COLUMBIA—*Phelps Dodge Corporation of Canada*, subsidiary of the United States firm, has opened an office at 904 Burrad Building in Vancouver to serve as Western Canada headquarters. The principal exploration office is in Toronto. The Vancouver staff will continue to handle the exploration in the Highland Valley area of British Columbia, and will participate in other Canadian exploration projects. D. C. Malcolm, resident geologist, will manage the office.

QUEBEC—*Raglan Nickel Mines* and *Hudson-Ungava Nickel Mines* have arranged for joint exploration of Raglan's 79.5-square-mile concession in the Ungava nickel belt. Diamond drilling is now underway. Under terms of the agreement, Hudson-Ungava has purchased 800,000 shares in Raglan, and will then hold options, extending until October 1961, on further shares sufficient to give it effective control of Raglan. Hudson-Ungava is jointly owned by *Rio Tinto Mining Company of Canada Ltd.* and *Societe Le Nickel* which has extensive nickel holdings in New Caledonia.

MANITOBA—*Lavant Iron Mines* has submitted cores from two drill holes to the *Ontario Research Foundation* for analysis and concentrations tests. The cores were taken from the 10-claim *Tulune Lake* property, 16 miles northeast of Lynn Lake. *International Nickel Company of Canada* discovered two large anomalies on the property in 1947. The holes drilled by Lavant are on one of these anomalies. Underneath 26 feet of overburden, both holes cut magnetite. Exploration is under the direction of R. W. Johns, consulting engineer.

ONTARIO—*Louphos Ore Ltd.* has postponed recruiting and training of operating personnel for its new iron ore mine and processing plant at Moose Mountain until demand for ore increases. Completion of the treatment plant is expected shortly. The company says it plans

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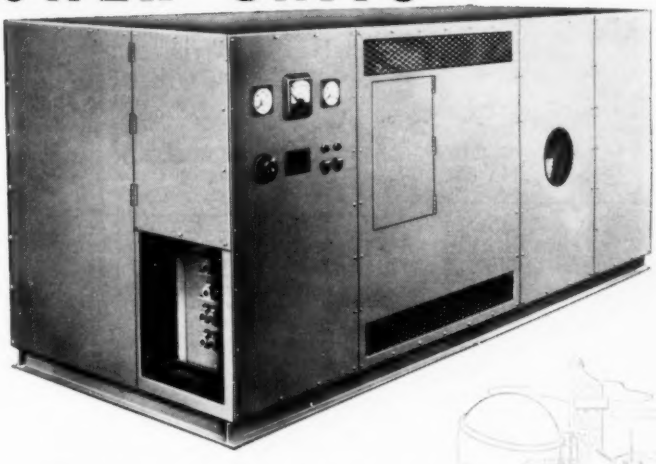

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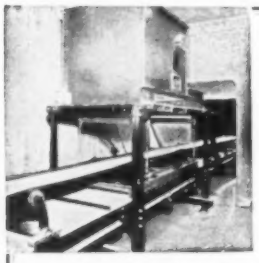

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October 14 through 16. Seminar on underground pressures and mine support. Sponsored by the German Academy of Science and the University of Freiburg, Leipzig, Germany.

October 20 to 23. The Seventh NATIONAL CLAY CONFERENCE, National Museum in the Natural History Building of the Smithsonian Institute, Washington, D. C.

October 23, 24, and 25. MID-AMERICA MINERALS CONFERENCE. All-Institute meeting with the St. Louis section of the AIME as host and sponsor. Chase-Park and Plaza Hotels, St. Louis, Missouri.

October 30, 31 and November 1. Annual convention of the NEW MEXICO MINING ASSOCIATION, Carlsbad, New Mexico.

November 6, 7, 8. Annual Meeting GEOLOGICAL SOCIETY OF AMERICA, St. Louis, Missouri.

February 5, 6, and 7, 1959. Western Mining CENTENNIAL CELEBRATION in connection with the annual convention of the COLORADO MINING ASSOCIATION, Denver, Colorado.

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to continue stripping overburden at the mine so that enough ore will be uncovered to permit mining when the plant goes into operation. With the steel industry now operating at about 52 percent of rated capacity, ore requirements are down proportionately and the company feels it must wait for conditions to improve. The project will have a capacity of about 550,000 tons of high-grade iron concentrate annually when in full operation.

PERU—Development of the *Acari* iron ore deposits is progressing steadily, and an air strip and primary access roads have been completed, as well as temporary housing and a shop and warehouse. Acari No. 1, the first ore body to be developed, contains ore assaying 65 percent Fe. The deposit has been blocked out and preparation for strip mining is underway. Approximately 10,000,000 tons of reserves have been proven, and geological work is being continued to block out other ore bodies for future development. Initial production of 1,000,000 tons a year is expected to begin by mid-1959, with the volume gradually increasing. The property is owned by *Panamerican Commodities S. A.* and operated by a subsidiary, *Cia. Explotadora de Hierro de Acari. Wells Overseas Ltd.* of Toronto, Canada is in charge of construction and development.

CHILE—The Chilean government has announced it will go before the *United Nations Committee for the Coordination of Strategic Materials* to seek approval for removing restrictions on the sale of copper products to the Communists. At the present time, Chileans have restricted sales to copper wire of less than ⅛-inch diameter. The government will also request removal of copper from the United Nations and United States lists of strategic metals, and will ask the United Nations to set up a system to prevent any country from dumping its copper reserves onto the international market.

PERU—Initial development of *Cia. Minera Condor S.A.'s* mine, *Condor No. 2*, is nearly completed and production of gold, silver, and copper is expected to begin within the next few weeks. To date, 40,000 tons of ore have been proven and geological conditions indicate even greater reserves are present. Monthly production is expected to reach 750 metric tons, containing 26 percent copper, 10 ounces of silver, and 0.12 ounce of gold per short ton. Low cost of treatment will leave a calculated profit of approximately $6.00 per ton of raw ore, it is reported.

CHILE—Production of blister copper has been stepped up at the Paipote smelter of *National Foundry Enterprise* near Santiago after installing a new converter. Production for June 1958 reached 1,830, only slightly below record production of 1,866 reached in January. Total production for 1958 is expected to be 18,000 tons, and will exceed 20,000 tons in 1959.

BOLIVIA—The *Bolivian National Chamber of Tin Mines* has asked the government to set up a domestic stockpile of surplus tin ore. The ore could be sold later when prices had improved and when the present export restrictions had been abolished. In addition, according to the Chamber, accumulated stock would facilitate the granting of loans to Bolivia.

CHILE—Some idea of the distribution of capital used for developing a modern metal mine may be gained from the following figures released by the *Anaconda Company* for the development of the *El Salvador* copper mine by its subsidiary, *Andes Copper Mining Company*. These figures do not include smelting or refining capacity. Railroad, $1,050,300; crushing plant, $3,263,500; pipe lines, $2,842,000; main railroad tunnel, $1,600,000; main shaft with hoists, $300,000; underground ore bins, $360,000; town development, $4,680,000; mine development, $5,400,000; exploration, $1,200,000; workshops, power and ventilation, $1,800,000; concentrating plant, $9,451,600; concentrating bins, $715,000; tailings dams, $300,000; roads, $685,000; excavations and communications, $400,000; power plant, $2,535,000; construction equipment, $3,050,000; warehouse, $50,000; engineering and supervision, $1,165,000.

MEXICO—Sulphur exports during 1958 will exceed 1,000,000 tons according to a recent prediction by the *Mexican Sulphur Institute*. Domestic consumption is expected to reach a record high of 10,000 tons as a result of the opening of several new chemical plants during the past months. Sulphur production for June was 100,830 long tons, compared to 110,556 tons during May.

ARGENTINA—A new company, *Norton Casale S. A.*, has been formed by the merging of *Carbmetal Mining Company* and the *Norton Company* of the United States. The company has undertaken a $500,000 project to begin production of granulated silicon carbide, using raw material mined from deposits in the Cuyo zone. Construction work has already begun on electric furnaces to be installed near Mendoza, and production is scheduled to begin by the end of the year.

COLOMBIA—*Frontino Gold Mines Ltd.* is continuing its development program, begun in 1957, to improve metal recovery and increase reserves. New sources of mill feed from small, adjacent mining properties have been developed, and new machinery, including standby Diesel power equipment to be used during dry seasons, has been installed. Gold production for 1957 was 187,204 tons milled with 105,062 ounces of gold recovered, compared with 137,145 tons milled in 1956 and 95,876 ounces of gold recovered. A $162,000 diamond drilling and exploration program carried on throughout Colombia has had encouraging results, and one or two additional mines are expected to be put into operation within the next two years.

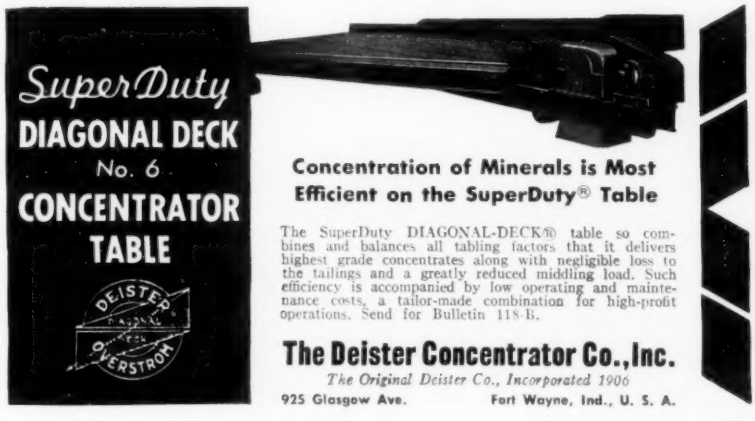
BRITISH GUINA—The *Demerara Bauxite Company*, a subsidiary of the *Aluminum Company of Canada*, has curtailed production and reduced its operating force from 2,050 to 1,500 workers, due to the decreased demand for bauxite.

BOLIVIA—*Patino Mines & Enterprises Consolidated, Inc.*, whose tin mines in Bolivia are now operated by the government-owned *Corporacion Minera de Bolivia*, has received payments totalling $294,213 during the first six months of 1958 as reparations on the price of tin concentrates shipped from the mines. Payments for the same period of time in 1957 totaled $541,366.

CHILE—Copper production from the *Anaconda Company's Chuquicamata* and *El Salvador* mines and *Kennecott Copper Corporation's El Teniente* mine may be increased from 430,000 tons to 520,000 ton annually within the next two years. Total investment of both companies needed to achieve this increase amounts to $131,000,000, according to a report from the Copper Department of the Ministry of Mines. Estimated 1958 production is 438,000 metric tons, with 31,000 tons to be exported to the United States.

PERU—Some consideration is being given to placing the *Santander* lead-zinc-copper-silver mine on a standby condition after preparing the mine for production. The property is being developed by *Cia. Minerales Santander Inc.*, in which *St. Joseph Lead Company* holds 60 percent of the stock. The management believes that Santander would be a profitable operation when nonferrous metal markets reach a stable condition.

ARGENTINA—*Compania Minera Los Marayes* (formerly *L.M. Piccardo y Cia.*) is now a new producer of zinc and lead concentrates. Sulphide veins in *La Blanca* and *El Azufre* have been opened up and a small flotation plant has been installed for treatment of development ore. Gold-bearing zinc ore is jigged before flotation, and gravity concentrates amalgamated. Operation of the cyanide plant at Marayes has been discontinued until more oxidized ore is available. The company is also operating the old gold mines of Gualilan where a cyanide plant has been installed.



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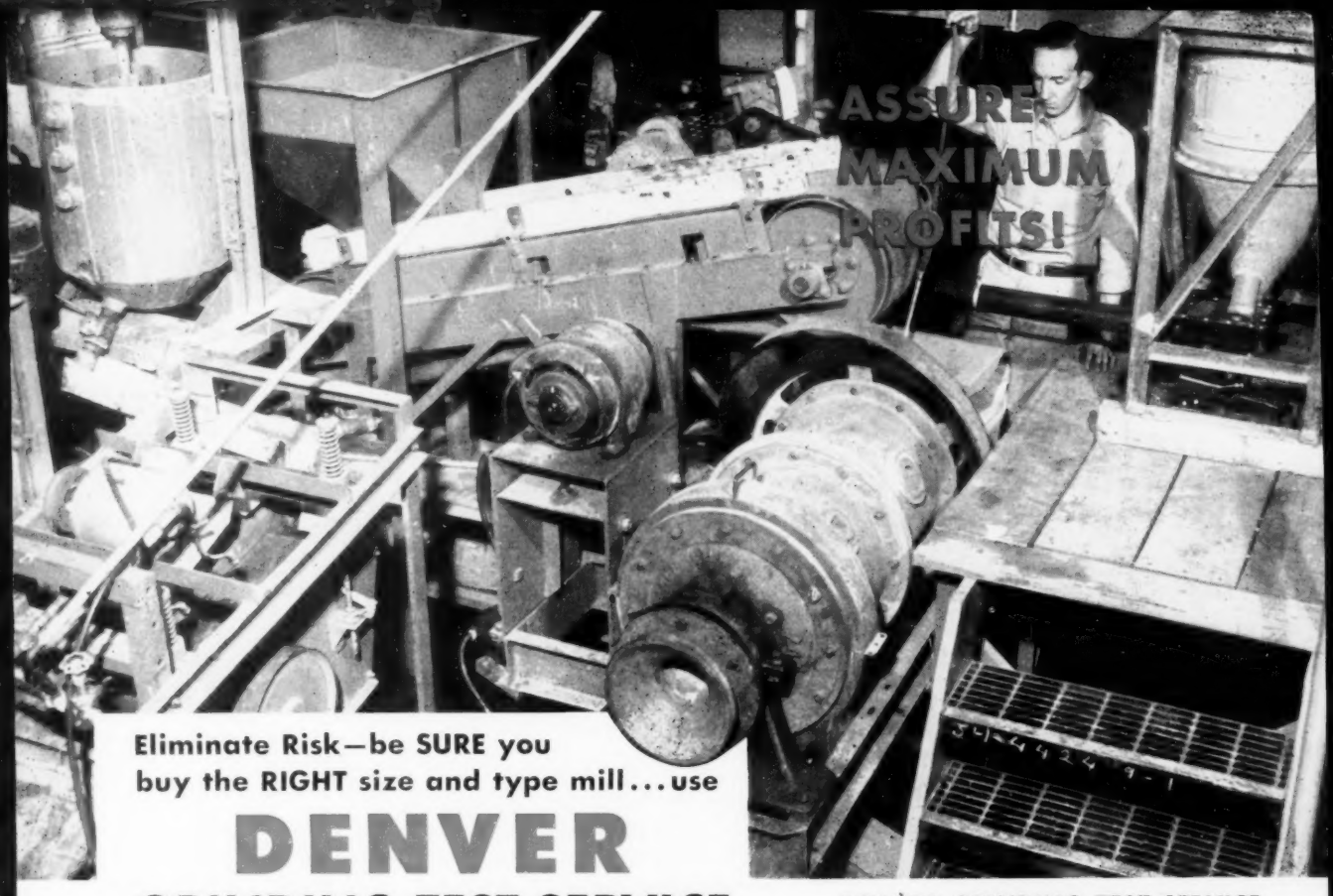

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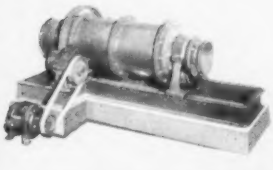

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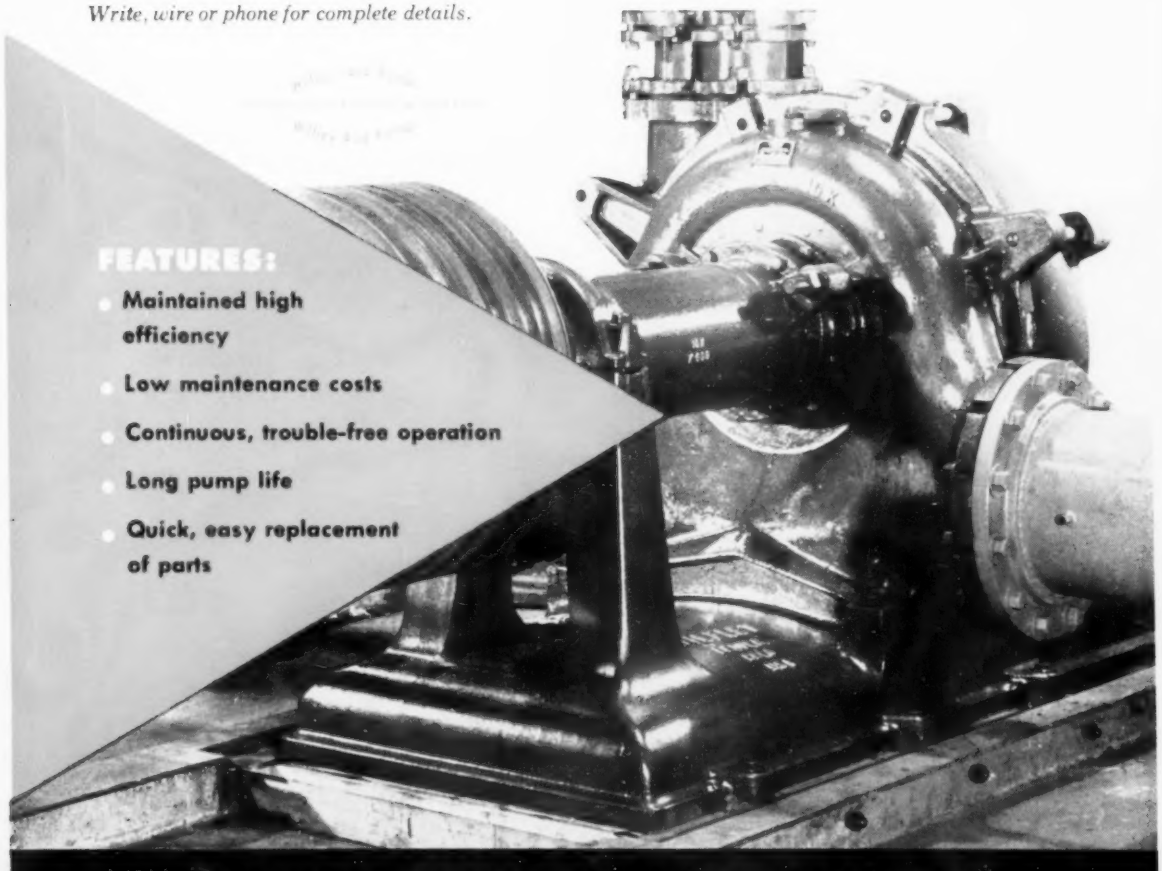

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